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WITH WHICH IS INCORPORATED

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The EDITOR'S REVIEW of the INDUSTRY in 1938

LIKE the foundry industry in the United Kingdom, that of the world has been what market reporters describe as patchy. In no country has it been really healthy, for where it has been showing gains, the improvement has been due in a large measure to armament orders. The American foundry industry taken as a whole has been depressed, while those of Germany and Italy have been working at high pressure. The French and Belgian conditions were far from satisfactory, as only those firms engaged in munition production were fully employed, but both these countries report some improvement during recent months. The most interesting report that we have received is from Prof. Pisek on Czecho-Slovakia, as he makes a survey of the results of the cession of territories following the Munich Agreement. It appears obvious that Czecho-Slovakia is determined to retain its position as the major industrial country in Central Europe. Many industries have been thrown out of balance, and their realignment will keep the country at full working pressure for many months, providing the necessary capital is forthcoming. Some of the adjustments indicated as necessary in the textile and brewing industries are worth the attention of the appropriate United Kingdom suppliers. The social legislation in force in some of the Scandinavian countries sounds advanced even to British ears, accustomed as they are to this type of enactment.

Last year was darkened by two major wars, which very seriously interfered with international trading, and by a major political crisis which had an even more baneful effect. This year, war is to be carried into the international trading field, and because of our commercial structure we are not organised for participation as strongly as the totalitarian countries; but the British Government has promised help to applicants. What type of help is to be given is a matter not yet disclosed to the public. Against the lack of large-scale organisation of British industry for export, there is to be credited a wholehearted dislike and distrust of the barter system by international trading interests.

United Kingdom Foundry Industry

The results of the investigation we have made do not altogether align themselves with the reports of either the districts or the sections of the industry. It may be that our personal contacts are established with the more enterprising firms, but the worst we can record is only a 9 per cent. diminution of the boom conditions of 1937. The range shown is particularly wide, embracing losses as high as 80 per cent. and gains up to 34 per cent. Nor can one point to equilibrium in the sections of the industry, and in future we shall scout the Stock Exchange reports which postulate that, following the unexpectedly good report of Jones, Smith & Robinson, some whole category of shares was marked up in sympathy. Within the same section of the foundry industry, one firm worked overtime, and is extending its premises and plant, while a competitor has been working short time!

In our *questionnaire*, we asked for reactions towards the provisions of the Factories Act. About 50 per cent. did not view them as being particularly onerous, but, of the remainder, 25 per cent. were very strongly antagonistic. The chief objections are directed against the regulations as to the employment of women and young persons, clothes drying and washing facilities, shop heating and crane inspection. One foundry manager reported that, although his concern found nothing really unreasonable, his output was being adversely affected by the Act. His foundry makes laundry machinery, and apparently the effect on this trade has been so harsh as to cause an increase in labour costs and prices to the public. The managements are so disturbed that they are hesitating before making capital commitments. The country jobbing foundries confide that they only know of the existence of the new Act through the Press! The lighting regulations have received general approbation. This is particularly interesting, as the lamp manufacturers for several years have been conducting excellent propaganda for the popularisation of adequate industrial lighting. In other directions it is noticeable that efficient and well-reasoned propaganda prior to the enactment of Home Office Regulations materially smooths the way for general willing acceptance.

Light Castings

Whilst 1938 has admittedly been a poor year for manufacturers of light castings as a whole, we are aware that there have been some outstanding exceptions. One firm has very materially increased its labour force, made important extensions, introduced a quantity of novel plant and is quite happy about the future. Amongst the makers of cooking ranges, both gas and electric, trade has been patchy. Some, in spite (or perhaps because) of intense mechanisation, have been kept quite busy. The export market has shown some deterioration, with a distinct tendency to pick up towards the end of the year, not only as to quantity, but also as to average price. For the month of November the quantity increased from 774 tons in 1937 to 950 tons last year, the value increasing from £57 to £61 per ton. The average value per ton in 1937 was something of the order of £53 14s., whilst last year it was £4 better at £57 14s. Naturally, this may be due to heavier deliveries of the more expensive types of stoves. However, the extra 176 tons exported in November means material progress and is a good omen for this year. Mechanisation is proceeding apace, and one light castings concern in the North of England has made an important installation of Sandslingers, whilst one in the South has pioneered a mechanised dipping plant for pipes.

The position of the bath importations is one deserving of close consideration. During the year well over 7,000 tons were imported, *i.e.*, nine month's work for our largest foundry. Working on an eleven-month basis, official statistics reveal that these baths were of the declared value of £25 6s. per ton in 1938, as against £24 16s. in 1937. November showed an increase of 238 tons compared with November, 1937, reaching 575 tons. Though the total imported will probably be about 1,000 tons less than in 1937, there is little real argument for the continuation of this import.

Pipe Founding

Because of the progressive policy adopted by the pipe-founding industry as a whole, the various firms have managed to keep their plants moderately well occupied. There has been a well-marked deterioration from 1937, but that year really was good. Nevertheless, plant extensions have been made at Stanton for the production by the centrifugal process of 4-in. pipes, and a spinning system is being installed at a Scottish foundry with French co-operation. The outstanding feature of the export market is a £60,000 loss and a like gain by the light and heavy pipes respectively. The loss in value of the exported pipes is less than 1 per cent., but the loss in tonnage, on an eleven-month basis, is 15 per cent. This is accounted for by the value per ton for the 6-in. maximum diameter pipes

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having increased from about £11 8s. to £12 12s., and the value of larger pipes rising from £8 4s. to £10 10s. It is pleasing to see that, as was the case with the stove-grate exports, prices on the international market have not been cut to ribbons.

Turning to imports, the situation is very satisfactory. During the first eleven months imports decreased in tonnage from 1,934 tons (£48,058 in value) in 1937 to 819 tons (£30,411 in value) last year. As these values work out at £24 and £37 respectively, it is obvious that there are more "fittings" than "pipes," and the reduction noted over the past few years is probably due to the establishment at Ipswich and Bedford of well-equipped plants well capable of supplying needs of the home market, and also entering into the export business.

Steel Founding

The statistics we have gathered give the rather surprising decline of 24.6 per cent. in employment, individual losses ranging from 2.8 to 50 per cent. We cannot convince ourselves that this is quite representative, and believe the figure to be on the high side. There was what to us was a surprising lull in the autumn, but with few exceptions all the manufacturers are optimistic for this year. There was a good deal of spontaneous appreciation of the work of the General Steel Castings Association. From an examination of statistics this industry very closely reflects armament production, and we can only imagine that the Treasury must have been applying the brake on the spending departments so as to preclude the creation of an artificial boom, which would have sent up the prices of raw materials and so injured our export trade. Finally, this would make the difficulty of paying for rearmament more pronounced than ever. As we have but scant respect for economists (with only a few exceptions—Keynes being one of them) we postulate our own views with appropriate diffidence. The steel foundry industry has in general been busy in extending the heat-treatment department, and a number of plants have bought new sand-preparing equipment, one has installed a mechanised system of mould production and handling, and another has provided itself with the very latest type of electrical arc melting equipment. Like the light castings industry, the steel foundry owners are a little proud of the fact that, although there has been a depression, it has not been seriously aggravated by insensate price-cutting. If the industry is losing business to other trades, then, as is now decided, the industry as a whole makes appropriate discounts from scheduled economic prices. We congratulate those who to our personal knowledge have devoted so much energy and time to the consummation of this decidedly improved state of affairs.

The steel castings industry of the North-East Coast has been reinforced by the creation of a new foundry at Jarrow. Since the war, a number of concerns, such as Spencer of Newburn, Sproat Marley, and quite a few others, have gone out of business, yet trade has not been too good in this area. It needs, and is worthy of, a real renaissance in shipbuilding and repairing. The rotary pulverised-fuel-fired plant installed at the London Midland & Scottish Railway's works at Crewe is unique in the whole industry as a steelmaking unit. It has been in regular production throughout the year, and has completely superseded the open-hearth process.

Malleable Cast Iron

It is appropriate that we should deal with this branch of the industry next, because the malleable trade needs exactly what the light-castings founders and the steel founders have got through the herculean efforts of a few pioneers. Trade has not been any too good, and there has been more than a modicum of price-cutting. The buyers of malleable are mainly the motor-vehicle industry, public utility enterprises and builders' merchants, all of which have the reputation of being able to skin a flea, yet as none of them is desirous of putting their suppliers out of business, they do not mind paying a *fair economic price* for their needs. This level can only be established by co-operation amongst the manufacturers. In general, the losses in trade have been of the same order as the general iron-founding industry—a matter of 9 per cent. or perhaps a little more. One firm, which always seems to classify itself under this heading, for the reason that it embarked on malleable-iron founding before extending its activities to grey iron, has organised a vitreous-enamelling plant during the year—though, of course, not for treating malleable. A good deal of re-equipment has taken place, but we would like to see more attention paid to continuous annealing instead of the batch process. This does not, and should not, necessarily involve "quick" anneal. There is a point where "quick" anneal meets "inoculated" anneal, and high-duty iron is more attractive in price. The field for malleable is at the moment too ill-defined. Insufficient stress is placed upon its magnificent machining properties, as exhibited by pipe fittings. A well-conducted employers' federation could do much to popularise malleable in addition to stabilising prices at an economic level.

Non-Ferrous Foundries

This industry, when divided into cuprous and light alloy, shows that the former has been working at something like 5 per cent. less than last year, due to a slackening-off in the indents made by the builders' merchants for plumbers' castings. The light-alloy foundries, on the other hand, have been working at a feverish rate, mainly for the aircraft industry. The makers of furnaces suitable for handling aluminium have enjoyed a record year. A new foundry has been installed on the North-East Coast, and one in the London area has been mechanised. Another London foundry has adopted the cement-sand process for propeller manufacture. Its success indicates that some of the iron-founders making marine-engineering castings might investigate this system with the object of stopping orders wandering across the North Sea. The reduction in ferrous raw material prices will help the manufacturers of plumbers' castings, as any major action to reduce building costs is bound to benefit this section of the industry. The manufacturers of light-alloy castings should use their respite from any worry about orders in order to investigate the vast field, still only scratched, which awaits intelligent cultivation. Such endeavours will bear fruit when the intensive demand for aircraft components has subsided.

Agricultural Implements

After a very chequered career since the beginning of the war, which nearly ruined it, this section of the industry is now thoroughly healthy, and is expanding. Especially is this true of the dairy and oil-engine section. So enterprising are the leading firms that their output surmounts the difficult tariff barriers in most parts of the world and, moreover, accomplishes this without resorting to the barter system. During last year, R. A. Lister put its highly-mechanised foundry into production, and this year the existing plant is to be doubled, proper provision having been made in the original plans for this addition to be effected under the same roof. The country jobbing foundries are gradually losing their grip on this industry, and work is gravitating to the larger concerns.

Steelworks Foundries

Foundries making ingot moulds have been kept reasonably employed except for a short period during the summer months. Mammoth moulds for armour plate aside, there is an increasing demand for ingot moulds of greater weight. To meet this, the largest Scottish ingot-mould foundry is extending and is catering for the greater sizes now demanded. Castings against orders for the new Turkish steelworks are now going through the foundries, although some have reached the delivery stage. "Outsize" castings for mill housings have been delivered to Ebbw Vale during the year. Rolls, too, are demanded in still greater sizes, but this section of the industry has very closely followed the downward trend of steel production, though orders for the new works have to an extent improved matters. This, too, helped in the lack of export business.

Machine Tools

No section of the industry, except perhaps light alloys, has been worked to fuller capacity than the foundries catering for the machine-tool building trade. Any slackness that has been encountered has been due to the inability of the machine-shops to take deliveries. In one case extensions have been made to take care of this. Ever since the British industry was protected by tariffs, machine-tool building has progressed materially. The technical advances which have been made are noteworthy. British literature on the subject is now well in advance of that published by any other country and augmentations are being made almost monthly.

Motor Vehicles

Reports show that there was a very definite decline in the demand for private cars, but after the Munich Agreement the market so improved that, when the Motor Show was staged, dealers placed sufficient orders to give a late autumnal spurt and a promise of healthy conditions for the present year. The lorry manufacturers have not been subjected to the same influences, and they have been reasonably well-employed throughout the year. A fair amount of money has been spent on re-equipment, but it has not attained the level of 1937, and shot-slinging plant, core blowers, moulding machines and conveyors have been the major items of expenditure. The ancillary trades, engaged, for example, in piston-pot and piston-ring manufacture, have been kept busy.

Electrical Engineering

It is somewhat difficult to assess activity in this sphere from our investigations. Manchester has been really busy, the Midlands somewhat less, though by no means general, and in the South a pronounced decline set in. On the North-East Coast, one firm, which has achieved a great reputation for its welded structures, has just announced large foundry extensions. All the largest manufacturers now have installed continuous pouring in their foundries, and the mechanisation of the core shops has been well established and will expand. The export business has been obtained in spite of intense foreign competition; moreover, success will continue in the major markets of the world, as, for the time being, the keenest competitors are not over-popular there, and friendship is still essential to business.

Textile Machinery

Business is non-existent, according to some Manchester pessimists, but this statement is far from the truth. The great Lancashire houses are still exporting to every corner of the earth. Unlike our Lancastrian friends, we believe their prospects during this year to be distinctly bright, despite Japan, Spain, and the hovering war clouds. Czecho-Slovakia is bound to enter the market to equilibriate her textile industry. The Anglo-American and the Egyptian trade agreements will both have beneficial effects. One firm, we learn, though it has not been working to anything like capacity, is extending its foundry in anticipation of better trading conditions.

Conclusion

Finally, we wish to thank very sincerely those hundreds of readers who have co-operated with us each year by providing the data upon which much of the foregoing remarks are based. To all of our readers we wish a very happy, peaceful and prosperous New Year.

Factors which restricted the output of—

PIG-IRON

By

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THE story of the pig-iron trade, particularly foundry and forge iron, to which this contribution chiefly refers, during 1938 makes entirely different reading from the tale of 1937. Even at the beginning of the year a marked change from the feverish conditions of 1937 was noticeable.

During 1937 stocks in consumers' hands were said to be non-existent, and the plea was frequently advanced that deliveries were no more than sufficient for day-to-day requirements. It was evident, however, as early as January, 1938, that considerable stocks existed in certain quarters, and specifications for delivery became difficult to obtain, and suspensions of deliveries grew apace.

TABLE I.—*Furnaces in Blast.*

Month.	No.	Month.	No.
1937.		1938.	
December	133	June	97
1938.		July	90
January	130	August	81
February	124	September ..	77
March	118	October	76
April	111	November	79
May	105		

Note.—These figures include all furnaces, whether making foundry iron or other sorts.

Furthermore, scrap, which had been dear in price, came along in plentiful supply, and fell to low levels, so low indeed as seriously to restrict the use of pig-iron. The natural consequence of these factors, combined with a steady deterioration in general trade which persisted throughout the year, can be deduced from the figures given in Table I of the number of furnaces in blast.

A more exact but like result is shown if one turns to tonnages produced, the figures being given in Table II.

The most striking decline, as will be seen, is in the relative proportion of hematite pig-iron to total production. This probably reflects a permanent trend away from this class of iron for steel making, and also a decline in so far as it is used for foundry purposes.

In view of these shrinking outputs, and the availability of cheap foreign iron, the Import Duties Advisory Committee was requested to consider the reimposition of the duties on foundry and forge iron, and this request was acceded to early in May.

Table III illustrates the position sufficiently, and points the moral that foundry and forge producers should apply themselves seriously to consider how the alarming decline in exports can be overtaken. This remark applies to all classes of iron.

Prices

Prices of foundry iron remained unchanged throughout the year, the delivered prices at Birmingham being:—Class 1, 113s. 6d.; Class 2, 111s., and Class 3, 108s. 6d. These prices were inclusive of the Loyalty Rebate which was brought into operation on November 1, 1937. A few days before Christmas, however, it was announced that the price of foundry and forge iron would be reduced as from January 1 by 10s. per ton. The price has not been fixed for any given period, but is subject to alteration as and when deemed necessary.

Bearing on the subject of prices it may be remarked that many consumers had bought heavily during the preceding year, and were thus "off the market" for some time in the early months of 1938. Other buyers not so covered felt that pig-iron prices were at their peak, and confidently looked for some easement. This sentiment continued throughout the year, and contributed to a constant decline in purchases, relieved only by a brief spurt of activity during the crisis days of September.

The opinion is held in some directions that a reduction in price on June 30 would have stimulated demand. As against this the producers, despite the considerable cut in coke prices, felt that, having regard to the reduced demand and its relative effect on costs, coupled with additional charges which had accrued, conditions did not justify such action; they felt, moreover, that stabilisation in price to December 31 would assist the user by enabling him to define his position more accurately up to the end of the year.

Unfortunately, as events turned out, this experiment in the fixation of a firm-price period only succeeded in stabilising prices at boom levels after the boom had spent itself.

With the exception of this difference of opinion between producer and consumer, the associations controlling the foundry iron trade, namely, the Foundry Pig-Iron Producers' Association and the Central Pig-Iron Producers' Association, have steadily pursued their previous policy of cultivating friendly relationships with the consuming trades, realising the community of interest between them. Personal talks and frank discussions have taken place with representatives of the users' associations, and it is confidently believed that a better understanding of each other's problems will result therefrom.

The C.P.I.P.A., which was formed in 1929, and has functioned admirably ever since under a very loose constitution, in conjunction with the F.P.I.P.A. felt that the time had arrived to revise the somewhat indefinite regulations governing both bodies, and bring them into accord with present-day requirements. This has been achieved quickly and without friction, and both structures are now on a firm basis.

In passing, it is perhaps advisable to correct certain misleading and garbled statements that have appeared in certain sections of the Press as to the intention of these associations to dissociate themselves from the collaboration with the I.D.A.C. that has hitherto existed. On the contrary, both associations have indicated their desire and willingness to continue their voluntary co-operation with the I.D.A.C., but serving as they do over 3,000 consumers with varying

TABLE II.—*Production of Pig-Iron.*

Quality.	1929.		1937.		1938. (Based on 10 months.)	
	Thousand tons.	Per cent. of total.	Thousand tons.	Per cent. of total.	Thousand tons.	Per cent. of total.
Hematite	2,347.9	30.9	1,865.9	22.0	1,495.0	22.0
Basic	3,196.5	42.1	4,689.0	55.2	3,800.0	55.8
Foundry	1,473.2	19.4	1,567.3	18.5	1,200.0	17.6
Forge	275.2	3.6	176.4	2.1	155.0	2.3
Direct castings	80.0	1.1	7.2	—	3.0	—
Ferro-alloys	178.7	2.4	147.3	1.7	145.0	2.1
Other qualities	37.8	0.5	40.0	0.5	12.0	0.2
Total	7,589.3	100.0	8,493.1	100.0	6,810.0	100.0

TABLE III.—*United Kingdom Imports and Exports of Pig-Iron.*
(In thousands of tons.)

Quality.	1929.			1937.			1938. (Based on 10 months.)		
	Imports.	Exports.	Excess (+) or deficiency (−) of imports over exports.	Imports.	Exports.	Excess (+) or deficiency (−) of imports over exports.	Imports.	Exports.	Excess (+) or deficiency (−) of imports over exports.
Foundry and forge	47.5	199.0	− 151.5	136.9	87.0	+ 49.9	78.0	44.0	+ 34.0
Acid	2.6	246.9	− 244.3	50.6	66.0	− 15.4	18.0	34.0	− 16.0
Basic	71.9	9.7	+ 62.2	422.7	0.6	+ 422.1	260.0	0.1	+ 259.9
Other qualities ..	—	—	—	34.5	—	+ 34.5	44.0	—	+ 44.0
Total ..	122.0	455.6	− 333.6	644.7	153.6	+ 491.1	400.0	78.1	+ 321.9

and individual characteristics, a more speedy and efficient method of price fixation has been adopted.

Loyalty Rebate Scheme

This scheme has been in operation throughout the year, and, as its title implies, offers a drawback to those firms who undertake to draw their supplies of iron solely from the British associated makers. Unfortunately, the scheme has not worked out to the satisfaction of many important users of iron, by reason of the fact that certain founders who did not assent to the scheme have been able to buy foreign iron at prices far below the F.P.I.P.A. figures, even after the allowance of the rebate. This is a subject which is receiving serious consideration by members of the Association.

The second problem of greater magnitude and importance, namely, the consideration of the possibility of concerted action to promote the export of iron, is also engaging serious attention. Whilst it may not be desirable to adopt methods employed by totalitarian states in their entirety, the necessity for meeting such methods on their own ground is imperative, and as the present Government is believed to look sympathetically on such proposals, something may be achieved in this direction.

Technical Developments

Perhaps two of the outstanding features in the sphere of technical development are the progressive work done in regard to the desulphurisation of iron, and the machine-casting of pigs.

Foundrymen themselves have for a long time practised desulphurisation and general cleansing of cast iron by the use of sodium carbonate, which is added to the ladle as the iron runs from the cupola. As regards blast-furnace practice, the progress of acid-burdening is dependent even to a greater degree on the use of sodium carbonate. This is chiefly applied in the production of basic pig-iron, and the claims made are that there is a bigger resultant output, a smaller quantity of slag, and a reduction of fuel consumption.

The theory is, of course, to produce a slag containing an excess of lime, the function of which is to take up the sulphur from the burden, whilst at the same time the hearth temperature is low enough to yield a silicon content of 1 per cent. or less in the iron. Naturally, if the lime burden is reduced, the slag becomes acid instead of basic, and the sulphur content of the iron rises as a consequence. Under the latter circumstances the slag made per ton of iron is reduced, but the rate at which the furnace can be driven is increased. Thus, a bigger tonnage of iron is yielded on a reduced fuel consumption, but the sulphur contamination increases.

If this latter method is employed, it is necessary to use the requisite amount of sodium carbonate in the ladle, thereby bringing the sulphur content of the iron back to normal. The possibilities of this practice as regards foundry iron are more restricted, seeing that the hearth temperature has to be sufficiently high to yield a greater silicon content.

Under normal circumstances the proportion of basic to acid contents in the slag is lower than when the furnace is on basic iron. Therefore, as practically all foundry iron has to be remelted in the cupola, it would seem that the proper place to treat with sodium carbonate is in the ladle as the metal runs from the cupola, or even in the cupola itself. As indicated above, this practice has been in vogue in many foundries for years past.

Machine-Cast Pig-iron

The machine method of casting from the furnace is extensively employed in America, and has also been adopted widely on the Continent. It appears to be a growing practice in Great Britain. Obviously, where machine-casting is employed, the iron is chilled, and any grading by fracture is no longer possible, and the iron must be sold on analysis. Whether machine-cast or not, the demand for pig-iron to analysis is growing very rapidly in this country.

The difference in the physical condition of iron of the same analysis when machine-cast or sand-cast is chiefly in the state of the carbon in the finished pig. The act of chilling increases the proportion of iron carbide, and what would have been possibly a No. 3 fracture in a sand-cast pig would give a white iron in machine-cast.

No great objection can be taken to machine-casting from the point of view of hematite or basic iron, as any slight adjustment in the process using hematite iron could be easily made, whilst the absence of sand would be a clear advantage in the basic open-hearth process.

As regards foundry irons chilling certainly produces a serious difference in the melting temperature of the iron. It is, therefore, essential that all trace of the original chill should be eliminated during the remelting, so as to re-dissolve the iron carbide. This is a matter of cupola control, but unless the point is appreciated irregular and unsatisfactory results could follow from the use of machine-cast pig-iron. Particularly would this be liable to happen where machine-cast and sand-cast irons are used together in the same cupola, owing to the wide difference in melting points.

No doubt, as blast furnaces of larger output capacity become more common in this country, the use of pig-casting machines will extend, and so long as users of iron adjust their outlook and methods to the new conditions, then satisfactory results should follow.

Trade Outlook

He would be a bold man who would assume a prophetic rôle as regards the future. It is beyond question that trades such as textile machinists, jobbing foundries and the general light-castings trade (the last-named depending heavily as it does on the building programme) have suffered a reverse. Certain of the heavier trades, on the other hand, *e.g.*, machine tools, have not been affected to the same extent, probably these being to some degree ancillary to re-armament activities. Nevertheless, if one can premise an improvement in the political situation, there are at the moment slender evidences of increased interest in the iron and steel trade, and there are grounds for the belief that a certain volume of work has been kept in cold storage in expectancy of a price reduction.

The increased industrial activity in the United States, which by swelling the demand for raw materials will provide those countries chiefly engaged in supplying these primary products with purchasing power for the products of industry which they need, is bound to have its effect on world trade.

Bearing these factors in mind, it would not seem unreasonable to view trade conditions for the first six months of the coming year with a restrained optimism.

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some arresting fashion with the use of nickel in industry.

Miscellaneous

GIBBONS (DUDLEY), LIMITED, Dudley.—A combination calendar, desk diary and blotter of unique and interesting construction. An engagement diary at the left carries perforated leaves which cater for a week yet still maintain a calendar for the month. Each sheet of blotting paper is interleaved with well-printed illustrations of the firm's productions.

FERROUS LIGHT CASTINGS, LIMITED, Warrington.—A bronzed cast-iron oval ashtray of generous dimensions.

Dates and Data

WE acknowledge with grateful thanks the receipt of the following diaries and calendars. In doing so we wish to reciprocate very heartily the messages of good will which accompanied them.

Diaries

BRITISH & CONTINENTAL TRADERS, LIMITED, Lincoln House, High Holborn, London, W.C.1.—A four days to the page diary, prefaced by several pages of technical data particularly applicable to foundry work.

J. GRAY & SONS, LIMITED, 5, Victoria Street, London, S.W.1.—A seven days to the page diary which includes data specially assembled for the benefit of vitreous enamellers; there is an inset of squared paper, whilst the cover carries pockets for visiting cards, stamps, and letters.

THE FRODAIR IRON & STEEL COMPANY, LIMITED, Fenchurch House, London, E.C.3.—A vest-pocket diary with four days to the page, the corners of which are perforated, so as to provide an automatic place mark.

STANTON IRONWORKS COMPANY, LIMITED, near Nottingham.—A week to the page pocket diary containing some 70 pages of commercial and technical data appertaining to cast-iron pipes and joints.

J. STONE & COMPANY, LIMITED, Deptford, London, S.E.14.—A vest-pocket diary carrying four days to the page.

STEWARTS AND LLOYDS, LIMITED, of London and elsewhere.—A four days to the page diary. Very useful annotations are included such as the great sporting events and the meetings of the technical societies. It is prefaced by a few pages of really useful data.

JOHN G. STEIN & COMPANY LIMITED, Bonnybridge, Scotland.—A four days to the page diary containing matter chosen for its real worth to users of refractory bricks. In addition there is a series of maps, which are more popular than most people would imagine.

THOMAS & CLEMENT, LIMITED, of Llanelly, South Wales.—A two days to the page diary, providing a space large enough to allow the modern Mr. Pepys to record daily doings.

Calendars

ASHWELL & NESBIT, LIMITED, Barkby Road, Leicester.—A daily tear-off wall calendar, each leaf carrying a Shakespearean quotation. It is mounted on stiff board carrying a picture of a portion of the Embankment.

DEMAG A.-G., of Duisburg.—Refills for their desk calendar—a system which allows of the prompt display of previously made notes of engagements.

HARRIS & PEARSON, LIMITED, Stourbridge.—A monthly tear-off wall calendar mounted on stiff board carrying diagrams of refractory shapes and sizes.

HOLMAN BROS., LIMITED, Camborne, Cornwall.—A monthly tear-off wall calendar, depending from a picture of St. Michael's Mount.

THOMAS ROBINSON & SON, LIMITED, Rochdale.—A monthly tear-off calendar depending from a picture of Childs Wickham in the Cotswolds.

STEWARTS AND LLOYDS, LIMITED, of London, Glasgow, and elsewhere.—A monthly desk calendar, the frame being white, edged with gold and decorated with the Union Jack.

SMITH & FAWCETT, LIMITED, Horton Works, Lidget Green, Bradford.—A monthly tear-off wall calendar, each leaf carrying a picture of the works, its shops or its products.

THOMAS WILKINSON & COMPANY, LIMITED, Middlesbrough.—A monthly tear-off calendar with space allowance for the inscribing of notes.

WRIGHT & COMPANY, 81, Clarence Street, Sydney, N.S.W.—A monthly tear-off wall calendar, each page carrying a picture connected in

(*Continued in previous column.*)

Major issues affecting—

GREY-IRON FOUNDRIES

By

FITZHERBERT WRIGHT

Director, The Butterley Company, Limited

BECAUSE of its complexity it is exceedingly difficult to treat the foundry industry as a whole, but as I understand the various sections are to be dealt with by experts in the various branches, my remarks can be confined to iron founding.

It is often erroneously assumed that trading conditions within the iron-founding industry are a reflection of the general industrial activity of the country, but this is by no means the whole story. The municipalities, for instance, very rightly regard a period of boom as being an inappropriate time at which to place large-scale orders for extensions to their various services. This feeling quickly spreads to the builders, and they, too, watch the movements of the raw material and endeavour to buy during periods of restricted activity.

"Buying Holidays"

Another interest of major importance to the foundry industry, which likewise takes a buying holiday during a boom period, is shipbuilding. Thus 1938 saw the beneficial effect of the rearmament programme being neutralised somewhat by its reaction on price levels, which has caused a slump in commercial shipbuilding, a slowing down in house construction, and postponements in the execution of extensions to municipal undertakings.

The foundry industry itself cannot be held to be entirely blameless for this state of affairs, which dates back to the spring and early summer of 1937. At this time, orders were plentiful, and probably through fear of enhanced prices for pig-iron, scrap and coke, a good deal of wild, unintelligent buying took place, and unmanageable stocks were created in the various foundry yards. Some concerns normally carrying a stock of the order of a few hundred tons expanded it to thousands. The boom of 1937 was never so intense that it demanded the neglect of normal business for the prosecution of work of national importance, and the exercise of foresight at that time by the industry as a whole would have gone far to stabilise trading conditions during 1938.

In general, it is wise to resist any temptation to legislate for boom conditions, and attention is best given to conservative expansions. Machinery has been so developed during the last two or three decades that it can cope with any heavy demand so as to flatten out the upper curves of the trade cycle well before real steepness is exhibited.

Particularly is this action shown in the lighter sections of the foundry industry, where, in recent years, due to mechanisation, there has been a concentration of similar types of work into a comparatively few plants. On the other hand, the buyers of such classes of goods as manhole covers, gulley grates, etc., have not yet taken full advantage of these cheaper production methods, and a great deal more standardisation throughout all counties, urban and rural district councils would be more beneficial to both consumer and producer. In this connection, it is very pleasing to note that the Metropolitan Water Board have given a lead by applying the British Standard Specification in its new form for their pipe requirements.

The Loyalty Rebate Scheme

An outstanding event of 1938 was the practical implementing of an agreement between the pig-iron producers and the foundry industry, the negotiations on behalf of the latter being carried through by the National Ironfounding Employers' Federation and the British Ironfounders' Association. The underlying principle of the scheme is that a rebate of 5s. per ton from the market price is automatically accorded to those foundries which give an undertaking not to purchase foreign pig-iron. This arrangement is obviously one-sided so long as it remains static. Its first repercussion was to augment the strength of the foundry employers' federations; especially has this been evident in West Midlands. Yet the germ of this notion of eliminating foreign pig-iron by a rebate system has not so far infected the foundry executive. To make use of it, he should extend the scheme to include his customers, even though it necessitated the creation of a number of interlocking agreements. Thus a builders' merchant could be compelled either "to buy British" or rely entirely upon imports from foreign sources.

The Crisis

Because people were so interested in the political and martial aspects of the Crisis which culminated in the signing of the Munich Agreement, little was learned of industrial reactions. There is a good deal of hear-say evidence that buyers were giving large verbal orders—subject to confirmation later—in case of the outbreak of hostilities, for deliveries of raw materials, and it is reasonable to believe that such a regrettable occasion would have been followed by panic buying. The consummation of the Munich Agreement has materially strengthened Germany's economic structure. This may be all to the good for world-trading conditions, as the issue of quotations by commercially-unsound concerns has a possible harmful reaction upon healthy competition. Increased German prosperity would probably see the end of the questionable barter system, to the betterment of world trade.

The Anglo-American Trade Agreement

The incidence of this agreement upon the foundry industry is somewhat difficult to analyse, especially at an early stage. Some of the industries which were started when the United Kingdom changed its tariff system will once again feel the full blast of American competition. Such articles as refrigerators, typewriters, and other typical trans-Atlantic productions will have to rely more upon their own selling-points and less upon tariff assistance. On the other side of the picture, it is as well to recall the dozens of foundries working for the textile industries of Lancashire, Yorkshire and Belfast areas, which should benefit out of all recognition. Those who can remember the baneful influence of the MacKinley tariffs on these areas will have good grounds for hoping for a real beneficial influence to accrue from the new agreements. The effect of increased trans-Atlantic traffic should do something to alleviate the present poor trading conditions in those shipbuilding foundries mainly concerned with commercial work.

The New Factory Legislation

The various provisions of the Factories Act which became law last year have had a very mixed reception. In general the larger and especially the newer concerns do not find them at all onerous. The small manufacturer is really perturbed at their incidence and finds their provisions to be so harsh as adversely to affect his business. Intermediately there is much grumbling, and for a concern capitalised at, say, £10,000, an expenditure of £100 per annum on crane inspection seems exorbitant. The best that can be said is that in many cases, compliance with the new provisions must be regarded as capital expenditure quite capable of contributing indirectly to the profit account. Adequate lighting and heating certainly enter this category. The section which has caused most comment is the interpretation of the clauses dealing with the employment of women, and clarification seems called for.

Export Markets

The export trade in this country, which does not greatly affect this particular industry, except indirectly, has, in my opinion, been very greatly assisted by the new Government policy of further extending the export credits facilities. It is interesting to note in this connection that the political point of view has been brought to bear on this subject, which will be an excellent bargaining factor in attempting to put an end to the system of barter agreements which are largely in vogue on the Continent.

If we, in this country, are to get our fair share of export markets, it will be necessary to wake ourselves up to a considerable extent and put our house in order. Different circumstances need different methods, and it is essential for our exporting industries now to get together to show a united front when going after foreign business instead of competing against each other and finishing up by letting the foreigner get the job.

The Future

The worst feature of promising to contribute an article of this character is that one is supposed to assume the *rôle* of Old Moore and give one's views on the prospects for future business. The efficient American business forecaster is invariably pessimistic, because if conditions prove him to be entirely wrong, the unexpected size of the profit account makes forgiveness easy, whilst

(*Continued on page* 26.)

A bad start but a better "finish" marked the year for—

MALLEABLE IRON

By

A. W. G. BAGSHAWE

Director, Bagshawe & Co., Ltd.

IT is an unfortunate but undeniable fact that malleable iron founders in this country, possibly with a few exceptions, had a very bad time during the first nine months of last year. This can be attributed to the fact that deliveries generally in the middle of 1937 were behind, and users were buying very much more ahead of their requirements than usual. Towards the end of 1937 the situation changed, and by the end of that year and in early 1938 a large number of users were carrying exceptionally big stocks. Consequently, in the early months of 1938 these stocks were being gradually used up, and very few orders were placed in the early part of that year.

The second cause was the general bad state of trade in the country in the early and middle parts of last year, much of which may have been due to political and other troubles of a similar nature. Fortunately, towards the end of the year, when the political situation began to clear itself, there was a very great improvement in the value of orders received, and in some foundries this improvement was sufficient to make up for much of the output lost during the early part of the year.

Price-Cutting Evident

Another misfortune arose in the form of a tendency to cut selling prices in the hope of attracting some orders without having due regard to manufacturing cost. It is unfortunate that this should have happened, as it could only result in a transfer of work from one foundry to another, without increasing the aggregate tonnage. Unnecessary price-cutting will obviously in due course reflect on the balance sheets of those concerns who adopted the practice.

As a typical example of the general fall in trade in the middle of 1938, the motor-car industry, which is the largest user of malleable iron castings in the country, suffered a very severe decrease in output, and it is very difficult to foretell whether this will continue during the coming year.

It is, of course, quite well known that the output of malleable iron castings in this country is proportionately very much lower than it is in, for instance, the United States. For some years past malleable iron has suffered considerable competition from forgings, stampings and welded parts.

Improved Material Deserves Extended Use

There seems now to be a likelihood of a reversal, and for malleable iron again to take its proper place. The situation is helped by the fact that the specification has been improved, and undoubtedly the quality of malleable iron is very much better than it was a few years ago. It would appear that some sort of intensive selling organisation is required to find new markets for malleable iron in the United Kingdom, but it is very difficult to say whether this could best be done by individual concerns or through some association acting in the interests of a number of separately owned and controlled foundries.

In this connection, the work that has been done recently with a view to revising specifications for both blackheart and whiteheart castings by the British Standards Institution with the help of the British Cast Iron Research Association and the Institute of British Foundrymen may be of very substantial value. The quantity of castings used in the manufacture of motor vehicles should be sufficient indication of the reliability of malleable iron and disperse the feeling of risk which undoubtedly did exist for many years in this branch of foundry practice.

New Materials Availab'e

During the past year much time and study have been devoted to the production of special types of malleable iron somewhat corresponding to the high-duty cast irons which are now being extensively manufactured. In other words, a number of more progressive foundries are making a serious effort to place on the market malleable irons of specially high tensile strength and with increased ability to resist abrasion and wear. In addition some useful work has been done in the way of alloy mixtures of an acid-resisting nature. Generally speaking, this work is being carried out by individual foundries in their own laboratories, but there is fortunately willingness in many cases for one foundry to help another, and not to try to evolve a secret process.

Progress of Short-Anneal Malleable

One of the great difficulties of malleable iron in the past has been the time absorbed by the annealing process and consequent delay in others. There does not seem to have been very great progress in the production of "short-anneal" castings during the past twelve months. Work, however, is still being carried on in an experimental way, and to a small extent in actual production.

Re-Equipment Problems

The restriction in the output last year naturally did not encourage the installation of new buildings to any great extent, and there is little likelihood of any great expenditure in that respect, unless trade generally improves far more than most people anticipate. On the other hand there have been fairly regular purchases of new equipment and machinery. The use of moulding machines, even on semi-repetition work, is becoming much more general in malleable foundries. There are now quite a number of useful machines which can be used for a variety of work, and which are being sold at reasonable prices. The use of better-cleaning machines, mostly of the shot-slinging type, and also of high-speed grinding machines is becoming more universal.

The core shops are also getting better equipment, the more important features being a wider use of core-blowing machines, of which there are now several types on the market, and continuous core-drying stoves, mainly of the vertical type. Malleable iron castings, being generally heavily cored in proportion to the weight, should gain increased popularity from this improvement in cores, as the appearance of castings is very much improved and machining expenses could be materially reduced.

Mechanisation Problems

A certain amount of mechanisation has taken place in some foundries, and there is no doubt that there will be further movements in this direction when orders are more plentiful. The ratio of the material handled to castings produced is exceptionally high in the malleable industry, which is one that lends itself to the use of sand preparation and distribution machinery for that reason. The use of correctly prepared and controlled sand should also help in the production of better and more attractive castings, and open the field for fresh markets.

Mould-handling machinery has so far received very little use in this particular branch of foundry work, owing to the difficulty in obtaining regular supplies of molten metal throughout the day, particularly in the blackheart foundry. There is, however, no doubt that some solution of this difficulty will be found in the near future.

Conclusion

In conclusion it may be said that during the bad period, the malleable iron industry held its own in comparison with other branches of foundry work. The success and expansion in the future must, however, obviously depend to a very great extent on the salesman and his ability to create fresh markets, provided always that the internal organisation continues to make genuine efforts to improve quality and appearance, and to produce at prices which are attractive both to the customers and ultimate users.

GREY-IRON FOUNDRIES

(*Continued from page* 25.)

if his estimates be correct, he can feel satisfaction in saying, "What did I tell you?"

Industries relying upon armaments—in which a strange lull was apparent during the later months of last year—can obviously rely upon working to capacity for some months.

Price reduction in raw materials will undoubtedly assist the heavy engineering and machine-tool trade, although keen competition in the latter will have to be faced from America.

The light-castings trade, which has been distinctly slack for the last six months, is now enjoying improved conditions, which should continue and make for a better showing than 1938. Industries which are mainly dependent upon municipal work may hope for brighter conditions, because the Government appears to be determined to continue its policy of social service in addition to the heavy rearmament programme. A.R.P. work will also contribute largely to prosperity in this section of the trade.

Conditions largely resemble those of 1938, with some improvement in the light-castings trade, motor vehicles and aviation.

I suspect there is rather more behind the Anglo-American Agreement than the ordinary man in the street knows, and if this be the case, I feel we can look forward to a much brighter 1939 both from the political and the economical point of view.

AT AN extraordinary general meeting of The Institute of Vitreous Enamellers in Birmingham last Tuesday, it was decided not to make any change to the Articles of Association, which definitely preclude the participation of suppliers of the industry in the active conduct of the Institute's business.

Price stability benefited the—

STEEL FOUNDRIES

By

HARRY A. BAIRD

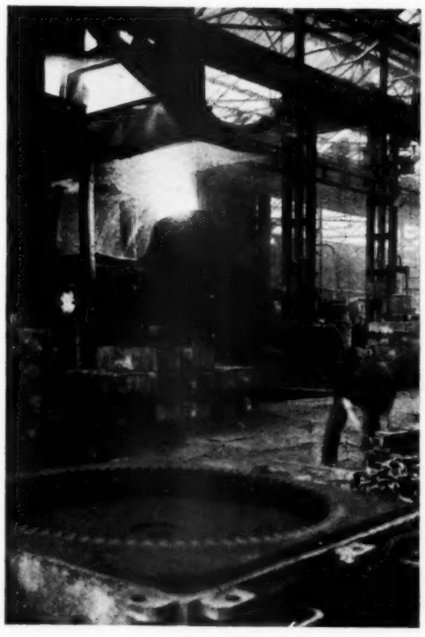
Archibald Baird & Son, Limited, Hamilton

THIS is the first time a contribution on the steel foundry industry for the Annual Review Number has come from Scotland. The author cannot help but feel a little honoured that the Editor has asked him to write it. Perhaps he, like many more people, has now realised that Scotland has come to occupy a very high place in the manufacture of steel castings, and perhaps in his selection he has made an effort to get one of the oldest makers. It may be interesting to know that the company with which the author is identified has been making steel castings for nearly 70 years.

At the beginning of last year the steel foundries were, as throughout 1937, working at high pressure, with outputs showing record figures and the outlook of the brightest promise. Unfortunately, before many months had passed the slowing down, already noticeable in other branches of the steel industry, spread to the steel foundries. During the first quarter of the year the steel foundries were working to capacity and hard put to it to meet their customers' wishes with regard to deliveries. A lessening of demand took place during the second quarter, which became still more pronounced during the third. Towards the end of the year a slight improvement set in, largely due to a speeding up of rearmament.

Price-Cutting only a Memory

The decline in the industry during the year has affected the steel founder less adversely than at any previous time, inasmuch as the double-edged sword cut only one way. As his tonnage decreased he had to meet the inevitable increase in oncost, but his prices remained stable. Thanks to the smooth and satisfactory working of the General Steel Castings Association the nightmare of price-cutting is now only an unhappy memory.



BLOWING A HEAT IN THE TROPENAS CONVERTER AT THE CLYDE STEEL AND ENGINEERING WORKS, HAMILTON.

Since prices of steel castings were stabilised, the steel foundries have had to meet an increase in wages and raw materials, often payment for holidays and expenses incurred in connection with the new Factories Act, without any corresponding increase in selling prices. The margin of profit throughout the year was therefore very reasonable, and consumers of steel castings had nothing to grumble about on that score.

A Boon to Consumer and Manufacturer

By good guidance and co-operation amongst the members, the General Steel Castings Association has made steady progress, many difficulties have been overcome and it is now established on a sure and firm foundation. It is beyond doubt proving a boon to consumers as well as to its members, for during 1937 and the early months of last year, but for the Association, prices would have been undoubtedly higher. Buyers have the satisfaction of knowing that their competitors cannot purchase on better terms than themselves. It is a personal hope that prices in the steel trade generally will again be stabilised over a period, as settled conditions are always the forerunner of good trade.

(*Continued on page* 28.)

POURING A HEAT FROM A TROPENAS CONVERTER AT THE CLYDE STEEL AND ENGINEERING WORKS, HAMILTON.

CASTING LIGHT WORK AT THE CLYDE STEEL AND ENGINEERING WORKS, HAMILTON.

A difficult and disappointing year for—

LIGHT CASTINGS

By

JOHN CAMERON, JUNR.

Cameron & Roberton, Limited, Kirkintilloch

AS 1937 came to a close, most foundrymen in the light castings industry heaved a sigh of relief, coupled with the hope that 1938 would not give them so many unpleasant shocks. There had been a very decided slackness in trade during December of 1937, but most authorities thought that this would be of a temporary nature. Unfortunately, their hopes were not justified, and matters soon became acute. During the first four months of 1938, trade diminished with alarming rapidity, reaching its lowest at the end of April. Unemployment again became severe, and most foundries were working on part time. This sudden change from the busy conditions of 1937 came as a most unwelcome surprise, for most foundries had been expecting a steady year. The causes of the recession have been discussed at length on many occasions, and while there can be widely divergent views on particular causes, there is no doubt that contributory factors in the light castings trade were the high prices of pig and scrap iron.

Factors which Held up Business

Since last April there has been a considerable measure of recovery, and the gap between the sales graphs of 1937 and 1938 has steadily become narrower, with the exception of the month of October, when figures were adversely affected by the almost complete absence of buying during the crisis. Recently there has again been a lull in buying, this time due to the modern tendency to fix prices for definite periods. At the time of writing, when it is probable that prices will soon fall, merchants naturally wish to reduce stocks to a minimum, and in an industry like that of light castings, doing a high percentage of merchant trade, this results in nearly a complete cessation of business for the period immediately prior to the announcement of price levels for the next year.

Now, with reductions in steel and pig-iron already announced, it is certain that cast iron will follow suit, and it is to be hoped that this will tend to release orders which have been held up for the past weeks.

The light castings industry has frequently been referred to as one of the best-organised industries in the country. This situation is no doubt due in part to the lessons individual firms have learnt by hard experience in the past, when years of intense internecine strife not merely reduced profit margins, but one can almost say increased losing margins to such an extent that the industry as a whole was reduced to desperate circumstances.

Due to the activities of the British Ironfounders' Association, founders have recently had vividly brought home to them the advantages of co-operation, and now that they have secured after many years a reasonable return on the capital invested in the industry, it is to be hoped that they will not recklessly abandon this position at the first trial of a trade recession. The advantages of co-operation in a period of bad trade are legion compared with the corresponding advantages when business is brisk.

Building Plans' 10 per Cent. Decrease

The activity of the light castings foundries is very closely associated with the value of building plans passed for erection. The significance of this figure is becoming more widely recognised, as it is the market index for many other industries than light castings, and by some is considered to be one of the major indices of commercial activity. The value of plans passed in the first nine months of 1937 was £83,811,500, and in the corresponding period of 1938, £74,913,900, or a reduction of 10.6 per cent. These figures, by the difference between the years 1937 and 1938, give the real reason for the period of poor trade which is at present in progress; but an aggravating factor is that many plans have been passed but not started, due to the high costs ruling in the building industry.

The Ministry of Health have published figures showing that more than 400,000 houses are still required to meet present-day standards of housing, and this figure would serve to indicate that there will be considerable demand for light castings from this source alone for several years. It must be remembered, however, that slum clearance building does not use the same volume of cast-iron products as was consumed during the boom period in private and speculative building in 1936 and 1937.

How Sections of the Trade Fared

Individual sections of the industry such as small engineering castings, baths, cooking appliances and builders' castings have all felt their share of the slackness in trade, but the worst repercussions appear to have been felt by the rainwater and soil-pipe group. Conditions in the bath section of the industry are very difficult with manufacturers and merchants unable to agree to any degree of co-operation. The newer designs of heat-storage cookers continue to attract attention, and there are now more than half a dozen makes available.

Actual conditions in the industry are clearly shown by the unemployment returns for the past few months. In December, 1937, the Iron-founding Workers' Association reported that 200 members out of a total of 11,900 were unemployed: by June last year the number of wholly unemployed had risen to 1,080, while at the same time over 2,700 were working on short time. Figures at December 19, 1938, were 926 wholly unemployed and 2,088 on short time.

In conclusion, 1938 can be summed up as one of the most difficult and disappointing years since 1932, with a reduction in the tonnage sold of at least 25 per cent. compared with 1937, and in spite of increased prices, a very material reduction in the value of sales. He would be a bold man who would attempt to forecast the result of the coming twelve months, with rumours of wars as an additional hazard; but whatever comes, the industry managed to hold its own in the period of intense demand in 1937 and has also come through a period of very pronounced depression in 1938. Those in the industry hope that 1939 will bring with it conditions somewhere between the two, which perhaps is the unattainable ideal of a completely contented industry, when demand is steady and just sufficiently brisk to keep everyone busy.

STEEL FOUNDRIES

(*Continued from page 27.*)

The author believes that if the General Steel Castings Association could be so developed that the work could be allocated in such a way that each steel foundry would receive the work which it is best laid out to manufacture, and that each steel foundry specialised as far as possible on particular classes of castings, costs of production would be considerably reduced and a very much improved product would result. This is perhaps looking a little too far ahead, but some day this ideal may be possible of achievement.

Technical Progress

On the technical side no outstanding developments have taken place, but quality has improved and real progress made in meeting the ever-increasing demands upon the steel founder. Steel castings are steadily becoming more intricate in design, and the design is more often than not arrived at without the slightest regard to any difficulties the steel founder may encounter. If the designer of intricate castings would collaborate more with the foundry much trouble would be saved to everyone concerned.

There has been an increase in the use of fabricated materials in place of steel castings, but there are strict limits to what can be produced in this way, and in many cases users of such products have, for various reasons, returned to the foundries for their supplies. It is not thought that the steel founder has much to fear from this competition.

During the year under review the new Factories Act came into force and a large amount of money was spent in bringing the foundries into line. It is satisfactory to note that, in what is really one of the dangerous trades, there were very few serious accidents, thanks to the foresight of those in authority and the work of the safety-first committees.

The industry can congratulate its members on the results of the past two years and, whatever may happen in the years to come, the steel founders, if they stick together and continue in that friendly spirit and mutual helpfulness which has always been a power of strength to them, should have nothing to fear. As Mr. Chamberlain said at the Lord Mayor's Banquet recently: "Let us not conjure up troubles which may never arise. Let us rather set about our several tasks with a determination that the New Year shall be more prosperous and happier than the old."

A 25-year review of progress in—

HIGH-DUTY CAST IRON

By

HORACE J. YOUNG

Sheepbridge Stokes Centrifugal Castings Company, Limited

A REVIEW of the progress in high-duty cast irons during the past twenty-five years takes us back to the beginning of the Great War, to the start of superheat being applied to large engines such as those for ships, and to the first Diesel engines of great horse-power. Hence, if this review is to be honest, it must unfailingly and fearlessly show exactly what progress has, in fact, been made over those years.

Saturated-steam is wet steam, so when a saturated steam engine is fitted with superheaters the steam becomes dry. This caused the first bad cylinder wear with which the author had to deal. It was overcome to a degree of commercial satisfaction by making grey all-pearlitic cylinder liners, containing no alloys. This was in the days when one constructed one's own optical bench. Similar liners were made of high-sulphur iron, namely, a sulphur content as high as 0.24 per cent. These liners were some of the best-wearing the author has ever known and, he believes, are in existence to-day.

Casting Diesel-Engine Cylinders

The Diesel engines were of the order of 1,000 h.p. per cylinder. The cylinders were cast at first with head and barrel as one complete casting weighing probably about 3 tons. They had to be perfect when finished-machined and to withstand a hydraulic test of 2,500 lbs. per sq. in. Later, the cylinder heads were cast separately, each contained about 40 cores, and the finished heads were submitted to the tests mentioned above. It is interesting to note that when the cylinder head and the cylinder barrel were cast separately the latter was called a cylinder liner, which anomaly has been taken further so that to-day it is called a "wet liner."

Therefore, in the year 1913 industry was quite capable of making successful high-duty castings, which are hardly, if at all, bettered to-day. The irons were all-pearlitic, and the analysis was controlled within limits rarely attained anywhere either then or now. The cupolas had volume meters and variable speed fans, the weighing scales were calibrated in pounds only, the decimal system was used throughout, and every item of the manufacturing processes and history of the castings was logged. Descriptions of these matters are in print and can be verified; also there are many people, now occupying high positions, who can substantiate the statements.

A Comparison

Further, in those days irons for high-class Diesel engines were manufactured which gave 18 to 21 tons per sq. in. tensile strength every time without fail. Eleven years ago at a works on the Tyne all such iron was made using nothing save pig-irons and hematites produced in blast furnaces within a few miles of Tyneside, steel scrap, cast-iron scrap and ferro-manganese. There were no additions whatsoever, and the cost of the raw materials was that of jobbing iron.

If one compares these matters with the fact that in 1938 the specification for highest-duty iron was raised to a minimum of 22 tons per sq. in., it will be seen that progress in plain grey iron has been—one hesitates to say it—almost negligible. Also it is no exaggeration to say that only a few modern foundries can reproduce the metals described above.

Early Improvements

Examining the historical record one is impressed by the idea that McLain of America rendered a great service to the ordinary foundries. He taught them how to use mixtures containing considerable proportions of steel, and he coined the name "semi-steel." Although no such material ever came out of a cupola, it was a fine selling name, the iron was

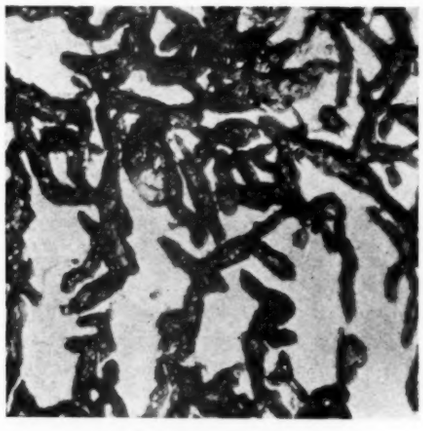


FIG. 1.—MICROSTRUCTURE OF SILAL. ETCHED. × 650.

better when properly made and, into the bargain, McLean destroyed some of the prejudices by which iron founding was bound. It is not to be forgotten in connection with the work of McLain in popularising the use of steel that nearly all the high-strength irons of to-day are high-steel mixes, with some additional treatment which defines them on the market.

Perlit Iron

The Lanz Perlit process arrived here soon after the Armistice and formed the main stepping-stone to the improvement and understanding of cast iron. This process obtained an all-pearlitic structure all the time and every time throughout the various sections of a complicated casting. It demonstrated the profound difference between accomplishing something by intent and doing so more or less haphazard now and again. Without doubt the process came here twenty-five years too soon, with the result that its main benefit was an educational instead of a commercial one. The pity of it is that true Lanz Perlit castings stand pre-eminent to-day for impact resistance, non-cracking and other properties invaluable to engineers. Curiously enough, the study of Lanz Perlit is similar to learning the metallurgy of cast iron turned inside out. For example, in ordinary practice the thinner and outer parts of a casting are those which chill and get unduly hard, and it is necessary always to legislate for the thin parts and let the thicker ones look after themselves; conversely, in Lanz Perlit the iron chills in the centre of the thickest sections and those have to be legislated for, while the thinner ones look after themselves. The vast amount of metallurgical knowledge wrapped up in this process cannot be discussed here, nor how it revolutionised and stimulated metallurgical thought as nothing did before or since.

Alloyed Irons

Two sources from which much progress and education have come are the Mond Nickel Company's work upon nickel cast irons and that of the British Cast Iron Research Association upon foundry practice and cast iron in general.

The latter under the guidance of Mr. J. G. Pearce has produced Silal and Nicrosilal as high-duty irons. It is always to be remembered that the word "high-duty" includes conditions, and each such metal is suitable only under those conditions. Silal, for example, is a 5 per cent. silicon iron of all-ferritic structure. Fig. 1 is a photomicrograph of the Silal manufactured at the works with which the author is associated. Its microstructure consists of precipitations of more or less globular graphite set in a silico-ferrite matrix. The high silicon content prevents solution of the graphite up to a temperature of about 900 deg. C. The iron does not withstand shock to any useful degree, but is exceedingly valuable for many furnace parts, superheater gear, etc., and is much sought-after for these applications.

Nicrosilal is Silal containing about 18 per cent. nickel and 2 per cent. chromium. It will stand quenching from a red-heat without cracking or its properties being degraded. Its structure, depicted in Fig. 2, is austenitic with some free carbide in the matrix. Whereas Silal is comparatively inexpensive, Nicrosilal, on account of its high alloy content, is rather costly but has other applications as well as those of Silal. For example, it will withstand considerable shock; it resists dilute acids and general corrosion. Under conditions it is found useful for ingot moulds, salt baths, manifolds, carburising pots and so on.

Nickel-Bearing Irons

The Mond Nickel Company have performed invaluable service not only in educating people to a series of high-duty irons but also in helping foundries over difficulties which could be ameliorated by the use of nickel in appropriate mixtures.

Nickel cast iron, for an example of the latter, is a medium-silicon iron (about 1.75 per cent.) containing from 1 to 1.5 per cent. of nickel, which casts well in light sections; the same iron with lower silicon, say 1.25 per cent., is used for heavier work.

The nickel-chromium irons cover a big range of uses. They are really the nickel cast irons

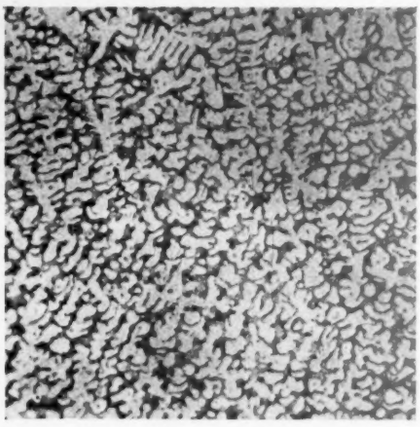


FIG. 2.—MICROSTRUCTURE OF NICROSILAL. ETCHED. × 50.

with about 0.5 per cent. chromium, the silicon being slightly lower as a rule. Their application is wide and the author's foundry makes very many articles of them. When the degree of heat-resistance is required to be improved, the chromium is raised to about 1 per cent. Their structures vary according to the practice and the needs, from pearlitic with some ferrite to pearlitic with considerable cementite. Usually they are quite machinable.

A white quality of nickel-chromium iron is made in the same manner only with silicon reduced to about 0.75 per cent. Doubling the amount of nickel in this latter composition results in a metal called Ni-Hard, which is a white iron of increased Brinell hardness, say, 500 to 650 in the various grades.

Ni-Resist is an invaluable contribution, as it is highly resistant to corrosion of various kinds and, also, will withstand considerable heat. Its uses are innumerable. The author's works makes for the automobile trade large quantities of austenitic non-magnetic cylinder liners, which are really Ni-Resist (see Fig. 3). One gets innumerable inquiries from those having corrosion troubles on plant handling corrosive effluents and so on. The Mond Nickel Company possess an organisation which collects information and willingly gives assistance under the leadership of Dr. Griffiths and a picked staff of experts, such as Dr. A. B. Everest, Mr. F. Hudson and Mr. McRae Smith.

Often, too, an iron is wanted which responds easily and accurately to heat-treatment; this is provided for by metal containing about 2 per cent. of nickel with or without a little chromium. Large quantities of die-cast rod are manufactured of this kind of heat-treatable metal, the die-casting making the rod perfect throughout any section.

The range of useful nickel-containing irons seems unending, and without doubt the Mond organisation has built up progress in this direction without which we should be sadly off.

Ni-Tensyl metal must not be overlooked as it is the same company's contribution to what are called "inoculated" irons. It contains about 1.5 per cent. nickel, which is added in such manner to the molten base metal that the resultant iron has from 18 to 26 tons per sq. in. tensile strength according to section. The author's works make large quantities of Ni-Tensyl castings for engineers requiring metal of reliably high strength, which, in many cases, enables them to reduce scantlings and lighten the job. In some circumstances, Ni-Tensyl is employed successfully for parts previously made in light non-ferrous alloys, a point of great importance considering the valuable properties of cast iron as a bearing and wearing material.

Meehanite

Meehanite is a newcomer to this country though it originated as far back as 1922. Its success as a commercial product coincides with the time when Mr. Oliver Smalley, one of this country's great research workers, went to America and took it in hand. It is made in a number of grades, but the author is unaware how many may be classed as high-duty irons. The topmost grade ranks with the best. Meehanite is a process of inoculation of a white or mottled iron to cause it to give grey castings of high-strength material.

An exceedingly heat-resisting and scale-resisting iron developed in the author's works is called Enduron. It contains very high chromium content and gives a tensile strength between 36 and 48 tons per sq. in., according to the method adopted for casting; the centrifugal method, for example, results in metal of 43 to 48 tons per sq. in. It can be hardened and tempered. It stands up to temperatures of over 1,000 deg. C. and is finding many useful applications.

A new range of all-pearlitic grey irons, called "Loded" irons, are beginning to progress. Briefly, they are metals containing high silicon, say 3 per cent. upwards, brought to all-pearlitic condition by chromium. For example, a "Loded" iron may contain 4 per cent. silicon, 2.5 per cent. chromium and some molybdenum and still be a machinable casting, although having 350 or more Brinell hardness. "Loded" irons offer a wide field for research. They possess good foundry properties, which fact tends towards the likelihood of their being applied to engineering use.

Nitricastiron is made at Sheepbridge in large quantities, particularly for cylinder liners. Mr. J. E. Hurst, so well known in foundry circles, has had much to do with this material. It is a special cast iron of low chromium content and

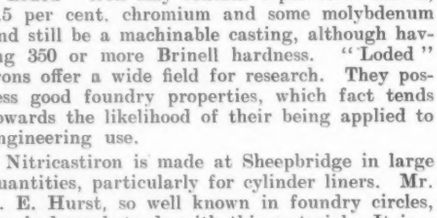


FIG. 3.—LOW-CARBON NI-RESIST. ETCHED. × 650.

some aluminium, which is capable of being nitrogen-hardened to a case-hardness of 800 to 1,000 Brinell. Liners of this iron, marketed under the name of "Centrard," give remarkably fine results on many engines.

Selection of High-Duty Irons

No attempt has been made to describe thoroughly the many grades and uses of the high-duty irons mentioned. Modern irons are difficult to deal with in an article of this type, because each one is an entity valuable particularly under defined conditions and overlapping one or more of the others when the conditions are not so defined. One might segregate them, in the first place, as follows:—(1) Slightly corrosion-resisting and inexpensive; (2) more and more corrosion-resisting and more and more costly; (3) very heat-resisting, but unsuitable to withstand impact or repeated stresses; (4) not quite so heat-resisting, but better able to withstand impact, etc.; (5) very impact-resisting and resistant to cracking under service conditions involving considerable, but not extreme, heat; (6) not very costly and showing general improvements upon ordinary irons in several directions. In other words, none of these high-duty irons serves all purposes. The manufacturer and the user need to get together and study the particular problem concerned before it is possible to select the high-duty iron best suited for the job.

Many of the irons dealt with in this article are centrifugally-cast, die-cast or sand-cast at the author's works. It is no uncommon occurrence to make intricate alloy iron castings up to 7 or 8 tons in weight or to cast thousands of alloy iron liners of a few pounds weight each in one day. Hence, high-duty irons have not only arrived, but are highly attractive for many engineering uses.

Anyone like the author who has worked in cast iron since the time when nobody, particularly a metallurgist, knew much about it, will probably agree that, had cast iron been developed upon equally unprejudiced and unrestricted lines of thought and research as have been applied to non-ferrous alloys in particular, this article would have been couched in very different terms, because, beyond all dispute, the progress herein described has been due to the striving of remarkably few people. For these reasons the author predicts that cast iron has got very far to go, and that the day will dawn when producers of non-ferrous and of steel castings will awake to discover that Cinderella has found her shoe and walked off with the "doings."

Book Reviews

Mechanical World Year Book, 1939. Published by Emmott & Company, Limited, 28, Bedford Street, Strand, London, W.C.2. Price 1s. 6d.

It was natural for the reviewer first to turn to the section dealing with cast iron to see the latest news from the engineering front. In this case he is well satisfied, except that he would have preferred mechanical properties rather than chemical compositions to be tabulated. The difficulties of compression, however, are well recognised and appreciated. In this edition a thorough revision has been made for both heavy and light non-ferrous alloys, as well as for steels. A general revision has also been effected for the mass of data it is well known to contain.

Metallurgie, 1939. (A Metallurgical Handbook.) Edited by R. Cazaud. Published by Dunod, 92, rue Bonaparte, Paris (VI). Price 25 francs, plus postage.

This useful handbook is divided into a number of parts, the first covering fuels and metallurgical apparatus, the second testing, and others dealing with heat-treatment and ferrous and non-ferrous metallurgy. It is logically set out, but despite this it fails in a few respects. Beyond the nitriding of cast iron and the heat-treatment of blackheart, matters of interest for the ironfoundry metallurgist are omitted where one would expect to find them. Thus all the new special irons are relegated to the non-ferrous section, appearing under nickel and molybdenum. The real worth of the book is shown by the fact that it has reached its 55th edition.

How the industry has helped in—

SHIPBUILDING and MARINE ENGINEERING

By

J. W. DONALDSON, D.Sc.

Scott's Shipbuilding & Engineering Co., Ltd.

THE year 1938 would appear, so far as returns show at the time of writing, to be the best production year in shipbuilding since the post-war boom year of 1929. The marine-engineering output is also high, but returns are not available to show whether the year's output will exceed the record output of the previous year for British marine-engineering establishments. The gross tonnage figures for shipbuilding and the horse-power figure for marine engineering for the United Kingdom during recent years are given in Table I, and are an indication of how these industries have improved during recent years. The year 1938 has also been notable in that it has seen the launch of the "Queen Elizabeth," a ship greater in size and tonnage than the "Queen Mary" launched four years ago, thereby making it the largest vessel built so far.

TABLE I.—*British Shipbuilding and Marine-Engine Output.*

Year.	Tons.	H.p.
1929	1,623,430	1,872,667
1930	1,569,679	1,880,223
1932	238,008	672,667
1933	161,209	328,513
1934	579,676	1,487,682
1935	540,803	1,003,255
1936	996,750	1,884,576
1937	1,067,662	2,389,084

Although the past year has been very good, the outlook for the future is not so good, as few new orders, apart from Admiralty orders, are coming forward to fill empty berths, and meantime the tonnage on hand is being rapidly finished off. Shipbuilders cannot construct ships cheaply enough to attract new orders, and replacements in merchant shipbuilding, which are required, are being held up due to the fact that new tonnage is not economic from the owner's point of view. In shipbuilding yards, therefore, which specialise in merchant shipbuilding the position is serious, and there appears to be little prospect of an improvement in the immediate future.

Reaction on the Foundry

This state of affairs has its repercussions in the foundry industry. The foundry industry (particularly the iron-foundry industry) supplies large quantities of castings towards the construction of marine engines, particularly where such engines are oil engines. As some 70 per cent. of the tonnage under construction at the present time is to be propelled by oil engines, iron founders engaged in the production of marine-engineering castings have been very busy, but with such tonnage being rapidly completed and no new orders coming forward there has been a considerable falling-off in the number of castings required. The shortage of skilled labour and the shortage of pig-iron and scrap, which has been very marked during the last two years, have not been so noticeable during recent months. The manufacture of castings for mercantile marine engines has been reduced to such an extent that, if it were not for the large Admiralty orders which are under construction and the large number of iron castings which are required for such work, those engaged in marine-engineering foundry work would be faced with a very serious outlook.

The falling-off in new orders for mercantile tonnage has not affected the steel and non-ferrous foundry industries to the same extent. The tonnage of steel castings required for Admiralty vessels is much greater than that required for merchant work, and the continued expansion of the Admiralty programme has kept steel foundries working to full capacity in spite of the falling-off of merchant orders. The same remark also applies to a greater extent with regard to non-ferrous foundries, as non-ferrous castings are used to a very much greater extent in Admiralty construction and also in more varied types of alloys than in merchant construction, except possibly in the case of high-class passenger liners.

Shipbuilding

In reviewing the applications of ferrous and non-ferrous foundry alloys to marine engineering and shipbuilding which have taken place during the last two or three years, a number of developments are to be noted not only in the application of new alloys, but also in the development and extension of new processes and technique. In shipbuilding there have been practically no changes so far as iron and steel castings are concerned, excepting that there has been a tendency to introduce alloy steel castings for stern-post and rudder frames. Steel castings containing a small percentage of vanadium have been used for such purposes, as the addition of vanadium to steel raises the strength slightly, increases the toughness and hardness and gives the casting a much better grain structure. A vanadium steel casting for the rudder-stock of the "Normandie" had a yield point of 20 tons per sq. in., a maximum stress of 36 tons per sq. in., and an elongation of 36.5 per cent. The use of castings of more complex vanadium alloy steels, such as vanadium-chromium, vanadium-nickel and vanadium-manganese, have also been suggested on account of their greater strength and the fact that they are easily heat-treated. Some very large steel castings have been made during recent years for such ships as the "Normandie," "Queen Mary" and "Queen Elizabeth" (Table II).

The applications of non-ferrous castings in shipbuilding show a marked tendency to increase, particularly in the construction of naval vessels and high-class merchant ships. Aluminium alloy castings continue to find favour mainly for fittings on account of their weight, and, provided suitable alloys are chosen, and painting or other form of protection is adopted as well as care in fabrication, so that metallic contact between such alloys and dissimilar metals is avoided, little trouble is experienced from corrosion by sea water. Aluminium bronzes or copper-aluminium alloys containing 9 to 10 per cent. of aluminium and up to 2 per cent. of iron and manganese, and having a maximum stress of 30 tons per sq. in. and a minimum elongation of 20 per cent., are being increasingly used for under-water fittings due to the strength and resistance to corrosion.

Regarding nickel alloy castings, Monel metal continues to be increasingly used for many fittings. Nickel-bronzes have not been used in this country for shipbuilding, but in Japan a nickel-bronze containing 9 to 12 per cent. of nickel, 1 to 3 per cent. of aluminium, and 0.5 to 2.0 per cent. of zinc is specified and used in naval work to replace gunmetal and naval brass. This bronze, when suitably heat-treated, has a tensile strength of 50.0 tons per sq. in., an elastic limit of not less than 35.0 tons per sq. in., an elongation of 25 per cent., and a Brinell hardness of 220, and is strongly resistant to corrosion by sea water, and would appear to be an alloy suitable for many parts where a saving in weight is necessary. Use is also being found for nickel-silver alloys, which, when they contain 20 to 22 per cent. of nickel, are very resistant to sea water and have a very pleasing white colour. Ships' bells and fittings are now being made in this alloy, and its use is rapidly extending.

TABLE II.—*Weights of Large Hull Castings (Tons).*

Casting.	"Normandie."	"Queen Mary."	"Queen Elizabeth."
Stern frame	102	190	190
Rudder frame	67	110	120
Rudder stock	47	—	120
Propeller brackets, after ..	112	180	180
Propeller brackets, forward	84	120	120
Stem ..	33	—	—

To eliminate, so far as possible and practicable, all ferrous metals from the hull and machinery of the new Royal research ship "Research," non-ferrous metals and alloys have been largely used in its construction. The hull has been constructed of teak planks on brass frames, and copper-sheathed teak has been used for the keel, stem and stern-posts. Aluminium bronze has been used for the anchor and anchor chains, and an alloy containing 81 to 84 per cent. of copper, 0.75 to 1.2 per cent. of aluminium, 0.85 to 1.40 per cent. of nickel, 0.80 to 1.30 per cent. of silicon, and the remainder of zinc for a variety of purposes in view of its special demagnetic properties, high tensile strength and resistance to sea-water corrosion.

Propellers

In the production of marine propellers, a new technique has been introduced in manufacture by the adoption recently by one or two well-known firms of the Randupson or cement mould-

ing process. In this process a mixture of pure silica sand, cement and water is used in place of green and dry sand and loam for moulding purposes and gives moulds of high strength and permeability from which gases formed during the process of casting are evacuated rapidly. It is stated that the surface of high-tensile brass propellers cast by such methods are close grained and dense as a result of the chilling effect of the mould and that a greater resistance to corrosion and erosion is thereby conferred.

Propellers for naval ships and for high-speed merchant ships are manufactured of high-tensile brass, and during recent years it has been found that an addition of 2 per cent. of nickel to such brass gives a higher combination of physical properties and renders it more resistant to corrosion and erosion. Special high-tensile brass propellers, containing approximately 50 per cent. copper, 44 per cent. zinc, 2 per cent. nickel, 1.75 per cent. manganese, 1 per cent. iron, and 0.5 per cent. tin and having a maximum stress of 30 to 40 tons per sq. in. and an elongation of 15 per cent. have been fitted to a large number of naval ships and to many British and foreign passenger ships with satisfactory results. Aluminium bronze with or without nickel also gives good results and recently small propellers have been cast of such material.

A problem of marine work is cavitation erosion of propellers, and recent investigations have shown that high-tensile brass containing nickel is 2½ times more resistant to cavitation erosion than high-tensile brass free from nickel. It has also shown that an alloy containing 56 per cent. copper, 36 per cent. zinc, 3 per cent. nickel, 2 per cent. manganese, 1 per cent. aluminium, and 1 per cent. iron is still more resistant than the special high-tensile brass just referred to (see Table III).

TABLE III.—*Cavitation Loss in 16 Hours in High-Tensile Brasses.*

Alloy.	Composition. Per cent.						Yield point. Tons per sq. in.	Max. stress. Tons per sq. in.	Brinell hardness.	Cavitation loss. Cub. mm. at 20 deg.C.
	Cu	Zn	Mn	Ni	Fe	Al				
H.-T. brass	58.0	40.0	2.0	—	—	—	14.7	29.0	114	252.0
Proprietary bronze ..	50.0	44.0	1.75	2.0	1.0	—	15.6	31.3	154	101.0
Special H.-T. brass ..	56.0	36.0	2.0	3.0	1.0	1.0	17.8	35.7	166	80.2

Welding

In reviewing the developments in shipbuilding and marine engineering some four years ago, the author dealt with the tendency in shipbuilding to replace such parts as cast steel shaft brackets by forgings, and to fabricate such parts as stem posts, either wholly or in part, from rolled steel by means of welding. Welding is now an established part of shipbuilding technique, and fabricated stem and stern posts and shaft brackets have replaced castings in certain cases.

For engineering purposes the use of welding continues to increase and many marine-engine manufacturers are now fabricating structural parts such as bedplates and frames by welding together rolled sections and plates instead of using iron and steel castings. In some instances, however, there has been a tendency to revert back to castings, as in the case of frames for certain types of internal-combustion engines. Shells for modern condensers are now almost entirely made by steel plates or section riveted or welded, or both riveted and welded, and have replaced cast-iron shells.

Recent developments in the construction of cylinder covers for marine oil engines have been their fabrication either by the electric welding of mild steel plates or the brazing together of cast steel bodies and forged combustion plates by means of copper-zinc brazing metal at a temperature of 1,200 deg. C. in an atmosphere of hydrogen. Covers fabricated by the latter process are said to give good results in service.

Marine Engineering

Few developments have taken place recently in marine engineering which have had any marked influence on the foundry industry, and ordinary cast iron, cast steel and non-ferrous alloys still supply the bulk of the castings required in reciprocating turbine and oil engine construction. There has however been a growing tendency to introduce higher duty alloys for all three types of castings. Ordinary steels having tensile strengths of 31 to 35 tons per sq. in. are suitable for turbine castings subjected to temperatures up to 760 deg. C., but for this temperature and higher temperatures, low molybdenum steels are found to be more satisfactory, owing to their higher yield points and greater resistance to creep and have been used in several cases. High-duty cast irons, owing to their higher strength, have also been used to replace ordinary cast iron for such parts in turbine construction as gear-case bottoms, gear-case covers, and gear-wheel centres in order to reduce weight.

The demand for high-duty cast irons, however, is more noticeable in oil-engine construction and particularly in high-speed engines, although there are many other parts in marine engines, particularly parts subjected to high temperatures or wear or both, such as pumps and valves, where such cast irons can be used with advantage. The recently-issued British Standard Specification No. 786 for High-Duty Iron Castings, in which minimum tensile strengths on the 1.2-in. diameter bar are specified as 14, 17, and 20 tons per sq. in., has influenced such demands, as many marine engineers now work to this specification. The development of low-alloy cast irons in order to meet the higher of these tensile strengths is also a feature of recent foundry practice.

Oil Engines

In high-speed oil engines the use of alloy cast irons, either of nickel or nickel and chromium, or of annealed cast carbon steel or cast stainless steel containing 12 to 14 per cent. chromium for cylinder covers has been general for some time. Recently, in certain types of engine, alloy cast irons have been replaced by high-duty unalloyed irons, and in engines where the cylinder covers are highly stressed and exposed to high temperatures, it has been found advantageous to replace cast steel covers with cast chromium-molybdenum steel covers.

High-duty cast irons continue to be used for cylinder liners both in low- and high-speed oil engines, and there has been a decided tendency lately to use cast irons of the inoculated class, both plain and alloyed, for the latter types of engine. In certain types of engine, where forged steel liners had replaced cast-iron liners, the use of such liners has been abandoned and cast-iron liners have been reverted to. To overcome cylinder wear, which is a problem with marine oil-engine builders, oil-hardened and tempered alloy cast irons have been used for cylinder liners for certain high-speed engines, and for a similar reason special cast-iron liners have been chromium plated to a thickness of some hundredths of a millimetre. Advantages gained by such treatment are stated to be less liner wear, less wear in piston and scraper rings and prevention of carburisation and sticking of rings. Liners so treated have been used in certain large cargo ships and have given satisfactory results after periods of running ranging from 2,000 to 3,000 hours and over.

Where aluminium-alloy pistons continue to be used in marine oil engines, such as submarine engines and auxiliary engines, the heat-treated Y-alloy and casting alloys of the R.R. group are generally specified. Another aluminium alloy which has been used recently is one containing 14 per cent. silicon, 2 per cent. nickel and 1 per cent. each of copper and magnesium. This alloy, which has a lower coefficient of thermal expansion but a greater thermal conductivity than the Y-alloy, has a tensile strength after suitable heat-treatment of 17.5 tons per sq. in. and a Brinell hardness of 130, and retains both its strength and hardness well at high temperatures.

Bearings in marine oil engines are usually tin-base white metals with or without lead. Recently some of the newly-developed bearing metals, including the copper-lead, cadmium-nickel, and lead-base bearing metals, have been used. Copper-lead alloys have been used principally in America and lead-base alloys in Germany. Cadmium-base alloys containing 1.3 per cent. nickel, and lead-base alloys containing 2.6 per cent. tin, 0.6 per cent. calcium, and small amounts of sodium, have also been used in Britain to a limited extent for bottom-end connecting-rod bearings in certain marine oil engines.

Nickel Alloys

High-duty non-ferrous alloys are also being used to an increasing extent in marine engineering. The bulk of such castings are made either from Monel metal or low nickel bronzes containing approximately 74 per cent. copper, 4 per cent. tin, 8 per cent. zinc, 14 per cent. nickel. Recently casting alloys of Monel metal containing either 2.5 to 3.0 per cent. silicon or 3.0 to 4.0 per cent. silicon, and having greater strength and hardness and greater resistance to wear, have been developed and found particularly suitable for parts in centrifugal and circulating pumps, for valve parts, and for steam injection nozzles. The low nickel bronzes susceptible to heat-treatment, already referred to, although not used in this country for marine work, have been used in Japan for gears, pinions and valve parts due to their greater resistance to erosion, and also to corrosion by sea water. K Monel metal containing 3.0 to 4.0 per cent. aluminium is also being used for valves and valve seats of marine oil engines in place of ordinary Monel metal, both in this country and abroad.

Use is also being made for valve seats and faces, of high-nickel bronzes and nickel-copper alloys to which varying amounts of hardening elements such as tin, silicon, iron or chromium have been added. The suitability of these alloys for such parts depends on their strength at high temperature, their resistance to abrasion, their greater hardness, and the fact that their coefficient of expansion approximates to that of steel. Such alloys usually contain 12 per cent. of tin, and the nickel content is varied according to the conditions which a particular alloy has to fulfil. The influence of tin additions to high nickel-copper alloys has been shown in a recent investigation, where with an addition of 20 per cent. of tin to a 70:30 nickel-copper alloy, a maximum age-hardness of over 500 Brinell was obtained in the quenched alloy, or a hardness increase of 350 Brinell over the annealed condition. Alloys of such high hardness offer definite possibilities in valve construction and for parts to resist wear.

THE ONLY IRON AND STEEL IMPORTS into the Tees last month were 405 tons of pig-iron and 58 tons of steel, the month's total of 463 tons comparing with 1,256 tons in November and 178 tons in October. The aggregate imports of iron and steel for the year 1938 totalled 43,607 tons, compared with 68,717 tons in 1937.

A year of great activity for—

The INSTITUTE of BRITISH FOUNDRYMEN

By

J. HEPWORTH, J.P., M.P.

President of the Institute

ALTHOUGH most people connected with the foundry industry are familiar with the work of the Institute of British Foundrymen, it is probable that few, even among its own members, are aware of the extent and variety of the activities it undertakes, and it is not until one becomes an official that the amazing variety of its interests is realised.

The aspect of its work which is most familiar is that which is carried out by its eleven Branches and five Sections all the year round by regular meetings in the winter, and visits to industrial plants in the summer. During the past year this work has continued vigorously, and a large number of Papers and lectures have been presented covering almost every topic of value to the modern foundryman.

THE INSTITUTE OF BRITISH FOUNDRYMEN

Members.

Honorary	18
Subscribing Firms	73
Members	931
Associate Members	1,056
Associates	126
Associates (Students)	29
Total	2,233
Branches	11
Sections of Branches	5
Junior Sections	1
Committees of Council and Special Comittees	8
Technical and Educational Institutions on which the Institute is represented	11
Branch meetings held during 1938	132

Papers presented in 1938.

Cast Iron	21
Steelfounding	5
Non-ferrous	6
Moulding, Coremaking and Patternmaking	13
Sands and Refractories	4
Furnaces and Fuels	5
Organisation	2
General Discussions	7
Branch and Section Presidential Addresses	8
Miscellaneous	9
Total	80
Nationalities represented in membership	17
Countries in which members are resident	26
Cities and towns in which meetings are held	24

The Bradford Conference

The annual conference is another familiar feature. In 1938 this conference was held in the writer's home city of Bradford, and we were particularly fortunate in the hospitality which was extended to us, the facilities which were afforded us by the civic and educational authorities of that city and by the industrial establishments, and by the members of the Institute throughout the West Riding of Yorkshire. I take this opportunity of expressing not only the thanks of the Institute, but also my own personal thanks, to all those who assisted and co-operated, and to the subscribers to the Conference Funds. Particularly would I express my gratitude to the officers and members of the West Riding of Yorkshire Branch of the Institute.

Each year the Conference and Branch activities result in a large number of valuable Papers being presented to the Institute. A selection of these is published in the annual volume of "Proceedings," and included in the volume which will shortly be issued to members is a valuable series of Papers on non-ferrous foundry subjects presented to the Bradford Conference. The value of this annual volume to foundrymen of every grade is considerable.

Technical Developments

The less familiar aspects of our work are equally valuable to our members and to the industry as a whole, and include such work as that of the Technical Committee, which through its Sub-Committees is engaged in a systematic study of problems of a technical character of importance to a rapidly developing industry. The Technical Committee is also the medium through which the Institute is represented on national and international standardising and specification committees. Educational work of a national character is carried out through the Education Committee; an Employment Bureau operated with the assistance of THE FOUNDRY TRADE JOURNAL has been of service to many members, and co-operation is maintained with other metallurgical and engineering institutions in this country and with institutions parallel to ourselves in other countries. My predecessors in writing these annual reviews have dealt with many of these features very fully, and it is not proposed to do more than mention many of them. There have been, however, certain developments during the past year to which more detailed reference must be made.

Among these developments has been the completion of the revised B.S. Specification for Grey Iron Castings and the new specification for High-Duty Iron Castings. The Technical Committee of the Institute, especially through its Cast Iron Sub-Committee, has taken a very active part in the preparation of these specifications. In order to provide authoritative information for the British Standards Committee engaged on the preparation of these specifications, the representatives of this Institute collected a considerable amount of data. After the issue of the specifications, the Cast Iron Sub-Committee of this Institute embodied these data in a valuable report which has been circulated exclusively to members of the Institute. The publication of this report marked a new departure, as it is the first time the Institute has issued a publication for the exclusive use of its own members, and it is expected that other special reports will be issued from time to time. The report is being discussed by several Branches of the Institute, and the reports of these discussions will furnish considerable material for the Committee's future work.

Technical Co-operation

The co-operation with kindred societies in this country is carried out partly by joint meetings and by invitation meetings. Among the institutions with which our Branches have co-operated in this way during the past year are the Institute of Vitreous Enamellers, the Institute of Metals, and the bodies with which the Iron and Steel Institute co-operate. Additionally, there is direct co-operation with the Iron and Steel Institute through inter-representation on certain committees, and in October last, for the second time in recent years, this Institute accepted an invitation from the Iron and Steel Institute to take part officially in its Autumn Meeting. At the meeting held last October the Third Report of the Steel Castings Research Committee of the Iron and Steel Institute was discussed, and many of our members participated. I take this opportunity to thank the Iron and Steel Institute for this much-appreciated gesture; I hope that such joint meetings may continue to be held and that the friendly relationship which already exists between the two bodies may be still further strengthened in the future.

The Institute has maintained very close associations with the British Cast Iron Research Association since the formation of that body some eighteen years ago, and the two organisations have co-operated on many occasions on specific problems and activities. Recently a Liaison Committee of representatives of the two bodies was formed with the objects of organising such co-operation on a more systematic basis, and of cementing still further the bond which exists between these two bodies who have so many interests in common.

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THE INSTITUTE OF BRITISH FOUNDRYMEN.

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Applications and Developments of—

FOUNDRY EQUIPMENT

AN EDITORIAL SURVEY

ALTHOUGH the foundry equipment industry has not maintained quite the same high level of activity as in 1937, the manufacturers were far from idle last year. Experience has been accumulating over a number of years on the mechanisation of foundries, and the installation of the necessary plant is no longer a matter of guesswork, but the sane application of economics to a manufacturing problem. The underlying principles were well established during the year by an address given to the London Branch of the Institute of British Foundrymen by Mr. G. E. France. The importance of such preliminary studies as were advocated has been underlined during the year by the dismantling of a fully-mechanised plant in the South of England. Mechanically, there was little wrong with the plant, but apparently it was a misfit for the line of manufactures made.

Some Mechanised Plants

The manufacturers of equipment did find that a number of well-thought-out schemes of modernisation were shelved during the year, and as we have been prophesying during the past few years, the marine and general engineering foundries in Scotland and the North of England have begun to buy modern plant. An outstanding example of a mechanised foundry which was opened last year is that of Listers, of Dursley, and this has operated so successfully that, according to the chairman's speech last month, it is to be duplicated this year. The brilliant red spots, showing lubrication points, which so abundantly decorate this plant, represent a system well worthy of extension to all foundry equipment. During the year, full-length descriptions have appeared in our columns of the Lister plant mentioned above; Parkinson's new foundry at Stechford, where, again, extensions are already envisaged; S. Russell & Sons, of Leicester, where a new foundry has been added and large extensions are planned following the release of some adjacent property; and Ruston & Hornsby, of Lincoln, where the outstanding features are the very extensive use of female labour for the making of the largest sizes of cores, the reclamation of core sand, the continuous cleaning of castings and an intelligent attempt to mechanise the large jobbing floor. This last objective, it will be remembered, involves the installation of a large modern sand-preparing unit at one end of the shop; the supply of sand along the wall, whence it can be fed to a mobile Sandslinger; the return of the sand below ground level and beneath the supply. Thus the Sandslinger closes the circuit.

During the year continuous casting plants have been installed in Coventry, Manchester, London and Glasgow, and there are in course of erection similar layouts in the Black Country, Nottinghamshire, Newark and Sheffield. These

(*Continued on facing page.*)

THE INSTITUTE OF BRITISH FOUNDRYMEN

(*Continued from page* 33.)

The International Congress

Co-operation of an international character with foundry technical associations in other countries is carried out partly by the Exchange Paper scheme, whereby we and several overseas foundry associations each provide a Paper at the annual congress of each of the other bodies participating in the scheme, and partly by participation in the annual International Foundry Congresses. In passing, it should be noted that the International Foundry Congress this year will be held in Great Britain in the month of June.

A large number of Continental and overseas foundrymen and their ladies are expected to attend this important gathering, at which the Institute of British Foundrymen will be the hosts and for the organisation of which it has made itself responsible. The Congress proper will take place in London from June 12 to 17, and will be followed by a tour of two weeks' duration of some of the principal industrial centres of the country under the guidance and largely as the guests of several of the Branches of the Institute. Considerable progress has been made in the organisation of this extensive and comprehensive congress, a number of important foundries in the London area and in the Provinces have invited the members of the Congress to inspect their plants, a number of well-known British, Continental and American authorities are preparing Papers for presentation to the Congress, and social functions and a programme for ladies are in preparation. The co-operation of every member of the Institute is sought to enable this Congress to maintain the high traditions of such congresses in this country, and to repay in some measure the boundless hospitality, the sincere welcome and the technical inspiration which our own members and ladies have received at International Foundry Congresses in many other countries.

Testing Cast Iron

Another important international activity in which we participate is the International Committee on Testing Cast Iron, a committee which has carried out much valuable work in endeavouring to standardise testing methods and specifications. At the last meeting of this committee held in Warsaw in September, Mr. J. E. Hurst, a Past-President of this Institute, was elected active President of the Committee. Every foundryman is familiar with Mr. Hurst's pioneer work on cast iron, and all will join me in congratulating him on the honour which has been accorded him. We can also congratulate the committee on choosing a President who will be a worthy successor to the previous active President, Mr. Joseph Léonard of Liége, himself an Honorary Member of this Institute.

During the year the Institute has also honoured Mr. Hurst by awarding him the E. J. Fox medal in recognition of his extensive and unique research work on cast iron.

The outstanding features of a domestic character have been the continued growth in the membership and the scheme for revising the qualifications for admission to the various grades of membership.

Membership Increase

During the last three years the increase of membership has been considerable, and the membership to-day has reached the record number of 2,233. Although mere numbers are of less importance than the value of the Institute to its members and to the industry, numerical strength is of importance, and this increase is very gratifying to all who are interested in the welfare of the Institute. Some sixty of these new members were added to the roll by the formation of the South African Branch about two years ago. Incidentally, this new Branch is contributing materially to the technical progress of the live and progressive foundry industry of South Africa. Recently the Institute of Australian Foundrymen has been formed. Although this is not an integral part of the Institute of British Foundrymen, several of our Australian members are interested in it and we in this country wish the new organisation good luck. We are in close touch with it and we will be glad to give it all necessary assistance.

The New Rules

The new qualifications for admission to the various classes of membership were approved at an adjourned annual general meeting held in October. It will be some months before they come into force, as certain formalities in connection with the Royal Charter have to be observed, and the scheme must then be submitted to His Majesty's Privy Council for approval.

The present basis for admission is on the designation of the candidate's position. The qualifications have not been altered substantially for over thirty years, and have not been altered at all since 1921. In the meantime, the personnel of the industry has undergone considerable changes. The possession of technical knowledge by the foundry manager or foreman is to-day the rule rather than the exception, and the technical control of the foundry has changed considerably. These results are largely due to the position which the Institute has itself created, and the Institute is now reorganising its own basis to meet the improved conditions which it has helped to create.

After the new regulations have been approved, admission will be on the basis of the candidate's experience and qualifications rather than on the name of the position which he holds. This is the procedure which has been adopted by most other technical and professional institutions with beneficial results to the institutions and to the individual member. As a result of this change membership of the Institute will in itself constitute a qualification, as membership of each class will imply that the member possesses the standard of knowledge and experience required for admission to that class.

Financially, the Institute usually manages to balance its budget as the result of strict economy in working. This economy, however, has exercised a restraint upon useful development work and in order to obtain the necessary funds to enable increased service to be given to the members, the new By-laws authorise an increase of the present modest annual subscription of two grades of the membership.

Conclusion

It will be seen that 1938 was a very active year in the history of a very active Institute. The reorganisation which is now being undertaken will enable the Institute to continue and to increase its work and the services which it gives to its members and to the industry. I hope that 1939 brings continued prosperity to the industry, the Institute and its members. I wish you all happiness and success!

FOUNDRY EQUIPMENT

(*Continued from previous page.*)

firms make *inter alia* such diverse materials as steel castings, non-ferrous bearings, pumps and electrical fittings. In general, the light castings (*i.e.*, the builders' castings) foundries are not mechanising to the extent that a superficial examination would indicate as possible, due inherently to trade union restrictions. However, an exception can be mentioned, where one large firm is installing four Sandslingers to manufacture this class of goods. It is worth emphasis that nowadays the conveyors of various descriptions can be regarded as trouble-free contraptions. A major difficulty, which all mechanised foundries have not overcome, is the sticking of sand in hoppers. Whilst the very nature of the sand is the chief factor, yet the initial preparation of the interior of the hopper by a proper application of blacklead or graphite will go far to minimise the trouble. Hammering with rammers will store up trouble for the future.

In connection with the annual conference of the Institute of British Foundrymen, we printed descriptions of a large number of works in the West Riding of Yorkshire, and amongst them were four which employed conveyors to a large extent. They were Hepworth & Grandage, of Bradford, which operates what must be the cleanest foundry in the world for the production of sand-cast piston rings; Broadbents, of Huddersfield, where the method of sand control breaks new ground; Hopkinsons, of the same town, where the sand preparation and distribution for the steel foundry is outstandingly excellent, and Blakeboroughs, of Brighouse, a firm which has successfully carried out the production of Meehanite castings by mechanised handling.

Machine Moulding

To-day, the equipment manufacturer well realises that any production claims put forward by him are useless unless the foundries have auxiliary facilities for handling the sand, the boxes and the finished mould. There is need for a succinct statement of the performance of the various types of moulding machines as unserviced units. Production figures apart, the machines present a definite appeal on account of their ability to eliminate the hard work of ramming, or to effect a more perfect draw, and so produce a casting dimensionally more accurate. On these grounds alone their installation is worth while. Yet properly serviced, they can be really effective as money-savers. No new designs have come on the market during the past year, but the electric type has been encountered in several new plants. Because of the incorporation of rectifiers, an easy method of automatic computation of the moulds made is afforded. The growth of the moulding machine trade in general is exemplified by a statement from a leading firm that their installations last year probably equalled the total sales to the foundry industry ten or twelve years ago. Yet they are only amongst the most prominent! It has recently been emphasised by a prominent foundry expert that it should not be assumed that the latest and most complicated machine is thereby the best for all purposes. A simple squeeze or stripping machine is still the ideal for certain types of production. When complicated quantity-production jobs are envisaged, then the power-driven jar-ram, squeeze, turn-over machines are an essential. The same expert insists that, generally speaking, no foundry is too small to neglect the possibilities of the simple moulding machine.

Sand Preparation

It is pleasing to see how all the various manufacturers have anticipated the fundamental requirements of the foundry industry in the provision of robust and technically efficient plants. They are using abrasion-resisting cast iron for the baseplates of pans, they have eliminated such projections as bolt heads within the interior of the mixers, and they have designed excellent filling and emptying mechanisms. The modern sand plant permits of rigid control, and those foundries possessing such plant in association with laboratory control are in a position to make better castings, well worthy of a higher price in the market. One foundry foreman whose products rank amongst the most complicated made by the foundry industry reported a gradual, yet amazingly rapid, reduction in scrap from 25 to 5 per cent. More encouragement should be given by the foundry to the equipment industry in the direction of the reclamation of sand. Up to now, the successful installations made are standardised in only a very few cases. A proper statement of requirements would result in still further improvement, for just as nations get the Governments they deserve, so, too, does an industry get plant commensurate with its technical development and aspirations. In the case of sand reclamation, once again the supply industry is probably in advance of demand. The equipment houses are to be congratulated on the way they have modified their standard plant to comply with the requirements of the new cement-moulding process.

Drying Stoves

If there be any phase of activity in the foundry industry about which we are profoundly ignorant, it is the technical creation of a drying stove. This ignorance is based upon an inability to correlate economic heat input with changes of atmosphere to avoid the ill-effect of moisture saturation. Thus we are full of admiration for what is being accomplished by the equipment industry, and it is a matter for congratulation that a prominent French motor-vehicle foundry has chosen a well-known make of essentially British design for solving its continuous core-drying problems. The brick-built mould drying stove is much more efficient than formerly, and foundries which habitually build to their own designs would be well advised to examine the new plant available, especially the handling facilities, for it is our belief that they would benefit thereby. During the year a new line of portable stove has come on to the market.

Shot-Blast Plant

The last few years have seen the introduction of the shot-slinging type of machine, and the progress now registered has well justified the confidence of the pioneers. The requirements of the industry are so diverse that the plant manufacturers are quite usually called to devise special apparatus for each individual case. In one plant, all the castings are segregated into two types, the smaller ones passing by conveyor through a continuous shot-blast cleaning drum, the speed of the conveyor regulating output. This obviously varies with the complexity of the casting being cleaned. The larger type is dealt with in a room, for which special transport arrangements have been made. An East Anglian foundry claims to have the largest shot-slinger type of rotary table apparatus in the country.

Melting Plant

Rotary furnaces, both oil and pulverised-fuel fired, are expanding at what can now be regarded as a normal rate. A new design of oil-fired furnace has entered the market, whilst a description appeared during the past year of the largest oil-fired rotary furnace in the country. It has been installed in Glenfield & Kennedy's works, and is engaged on the production of Meehanite high-duty iron. A number of new cupola installations have been made, and one of them in the Birmingham area has reverted to the Roots blower. Some evidence has been adduced in America to show that the potentialities of the blower have been inadequately understood and appreciated. In this country, however, the fan is almost universally accepted as being more suitable. A new method of automatic charging has made its appearance during the year, which shows many advantages. It is a curious fact that the most progressive section of the foundry industry, that is the motor-vehicle foundry, still adheres, generally speaking, to hand charging.

The firms manufacturing furnaces for the light alloy foundries have been working to capacity. During the year one well-known firm of furnace builders acquired concessions from a Paris house for the handling of a line of furnaces, several being suited for melting non-ferrous metals. In the near future, a prominent firm of foundry equipment manufacturers will announce the marketing of an entirely new type of pulverised-fuel fired rotary furnace.

Auxiliary Plant

The manufacturers of steel box parts, ladles, mechanical riddles, sand throwers and core-making machines, whilst obviously not so busy as in early 1937, have been kept reasonably well employed. In the case of steel boxes, there is no longer a rigid adherence to a standard type, but rather to a set of fundamental principles associated with precision finish to be incorporated into the design required by the foundry for the production of a line of castings. Ladles are nowadays of a more intelligent design than formerly, and it is pleasing to note that better maintenance is being observed. Despite that, however, a fair percentage could be scrapped and replaced to advantage. We are still not entirely satisfied with the level of ladle maintenance in the industry, which should emulate the standard set by the sand-cast piston-ring manufacturer.

Core-blowing machines have assumed such importance that no less an authority than the Chief Factory Inspector has commented on their influence on the personnel and conduct of the core shop. By co-operation, their teething troubles have passed away and they have proved themselves to be of the greatest economic value to the industry.

Conclusion

It is almost unnecessary to say that the supply of the ordinary loose tools of the industry has followed the general trading conditions. Excepting a major international disturbance it can be stated without any qualification that the immediate prospects for the equipment industry are definitely good. One excellent feature of recent years is the general disinclination of foundries either to provide themselves with home-made plant or even to co-operate with the equipment manufacturer in the direction of supplying the necessary castings as an integral part of new plant. This spirit should be encouraged by equipment makers, as nine times out of ten it is false economy for foundries to butt into other people's business. Though an attempt to make such an apparently simple plant as a sand-drying stove may be ultimately successful, a true ascertainment of costs, to include time spent upon it by managing directors, chief draughtsmen, foundry managers, and a host of other executives, would prove it to be excessively expensive when correlated with the standard plant readily available.

This year in the autumn there is to be held at Olympia, London, in connection with the Engineering and Marine Exhibition, a section devoted to foundry equipment and supplies. It is debatable whether or not this is preferable to a separate "foundry (equipment) exhibition," but it has the advantage of being more of a "foundry" exhibition as there are to be seen finished castings, both loose and built into machinery. In any case there is a lack of unanimity within the equipment and supply industry on exhibition policy, and possibly the present system of a biennial exhibition represents a happy *via media*.

Steady, not spectacular advance in—

REFRACTORIES and MOULDING MATERIALS

By

T. R. WALKER, M.A.

English Steel Corporation, Ltd., Sheffield

THE preparation and use of refractory materials have not displayed any spectacular advance during 1938, but the year has nevertheless been one of steady progress.

The profound effect of particle size on the properties of refractory materials is now fully realised, and the selective grading of such materials to assist in giving the properties desired in specified applications is being practised in nearly all sections of the refractories industry. Some types of sand may on occasion be found to occur naturally with a distribution of grain size which suits the intended purpose, but other sands, foundry "compos," raw mixtures for brick manufacture, and the constituents of plastic refractories, all demand special plant for producing the grading desired. Present knowledge regarding the selection of the best material for a given purpose, coupled with the ideal distribution of particle size, is, however, still far from complete.

When new types of material pass after investigation from the laboratory to the commercial plant and to large-scale use in industry, there is always a tendency for them to be tried under all kinds of service conditions, for many of which they prove unsuitable. It is only after a chequered career that they settle down to occupy a more or less well-defined position in industry. Chrome-magnesite bricks afford an illustration of this. Following the results of laboratory investigations in which they showed promise of giving good service under certain conditions, they are now being made by several manufacturers, and have lately been put into service under widely different conditions. Naturally, in some instances they have proved disappointing. Actually, the chemical composition of the raw mixture varies according to the source, so that it is scarcely to be expected that all chrome-magnesite bricks from the various manufacturers will give the same results when used for a particular duty. Difficulties of this nature will no doubt rapidly disappear as further experience in the use of such bricks is obtained.

Bentonite is scarcely a new foundry material, but its use in British foundries has lately increased considerably. It is, of course, an American colloidal clay found in Wyoming, and efforts —one successful—are being made to find deposits of equivalent material in Empire territory. Somewhat similar clays occur in Eire, in New Zealand and in Canada, but the samples so far examined are inferior in quality to Wyoming bentonite, as are also some Italian deposits.

Reducing Sand Imports

Moulding mixtures similar in some respects to synthetic silica-sand-bentonite-clay mixtures are used in the Randupson process, in which cement is employed as the binding material for a silica-sand base. The process is now being operated in this country for the commercial production of iron and non-ferrous castings, and it is at present being tried in a number of well-known steel foundries.

The recent crisis served as a reminder that a proportion of foundry refractories and moulding materials is still being imported from foreign countries. The resources of such materials in this country are, however, by no means exhausted, and the search for new British materials is being actively pursued. Three sands not hitherto used for steel-foundry work, one occurring at Erith, one near Chesterfield, and one near Wrexham, have been investigated during the last year by the Moulding Materials Sub-Committee of the Iron and Steel Institute, the first report of whose work has recently been published (extracts having appeared in this JOURNAL).

More Standardisation Needed

The testing of refractory and moulding materials in the laboratory has spread rapidly, and one result is that recently the methods employed in such testing have met with considerable criticism. The routine examination of foundry batches of sand mixtures is of great value in giving figures which may be compared with an internal standard, and so help in securing uniformity in the mixtures used. Examination of the same mixture in different laboratories, however, gives widely different results, and it is evident that to obtain similar figures the conditions of testing must be more closely controlled. For this reason, a joint committee was set up during 1938, consisting of representatives from the Iron and Steel Institute, Institute of British Foundrymen, British Cast Iron Research Association, and British Non-Ferrous Metals Research Association. It will act as a co-ordinating committee, availing itself of the results of investigations carried out by the technical committees of its parent bodies to set out recommended procedures for the testing of moulding materials used in this country. In America, the American Foundrymen's Association has, during 1938, issued a revised edition of its handbook on "Testing and Grading of Foundry Sands and Clays."

Another handbook recently published in America is a "Manual of A.S.T.M. Standards on Refractory Materials," issued by the American Society for Testing Materials. The conditions of testing refractory materials at high temperatures are being intensively investigated in this country, but much work still remains to be done. The introduction of high temperatures as an additional factor in testing naturally increases the experimental difficulties, since refractory materials under test must usually be contained in vessels made of materials even more refractory.

In the case of moulding materials, the temperature of sintering, at which the grains soften at their surface and frit together, is important in influencing the "burning-on" of sand mixtures, and the ease of fettling of the castings. Some results of investigations in this field are given in the report of the Moulding Materials Sub-Committee of the Iron and Steel Institute, already referred to, but the account should be regarded only as an instalment.

It is evident that, even if no further major developments occur in the near future, there is ample work for all concerned in completing the study in the laboratory of the materials now available, and subsequently in correlating their properties under controlled test conditions with their behaviour in the actual foundry.

A VIEW IN THE NEW 4-IN. CENTRIFUGAL-PIPE CASTING PLANT OPENED LAST YEAR BY THE STANTON IRONWORKS COMPANY, LIMITED.

Review of two years' work in the field of—

RESEARCH

By

J. G. PEARCE, M.Sc., M.I.Mech.E.

Director and Secretary, British Cast Iron Research Association

IF standardisation be regarded as an inevitable result of research—and experience seems to indicate that it is—then no review of developments in 1938 would be complete without reference to the issue by the British Standards Institution of the revised version of B.S. Specification 321, originally issued in 1928 as the first national specification for general grey iron castings. This specification marked the beginning of an entirely new epoch in cast-iron testing in this country, and it may be worth recalling that in 1931 the whole problem of cast-iron testing was discussed by a world conference of metallurgists at Zurich, held by the International Association for Testing Materials. As a result of discussion the Chairman, the late Dr. W. Rosenhain, asked by the meeting to report, said in his summary " . . . in the opinions of the great majority of those who took part in the discussion at Zurich, the use of a separately-cast test-bar to be tested in tension and bending is to be regarded as satisfactory and sufficient for the majority of industrial purposes. . . ." This had been standard practice in this country for three years. In addition, the issue of B.S. Specification 786 for high-duty irons now makes it possible for users of castings to purchase qualities higher, with the exception of one U.S. specification, than can be obtained from the national specifications of any other country.

Photomicrography

As last year the B.C.I.R.A. President, the Rt. Hon. the Earl of Dudley, devoted his article to other matters, it is convenient to review research developments from the Association for the past two years. Towards the end of 1936 the Institute of British Foundrymen published Series 2 of " Typical Microstructures of Cast Iron," in collaboration with the Association. This continued the first series, published in 1933, and gave a variety of grey, chilled, malleable and other structures. The Association hopes in due course to issue illustrations of cast-iron structures produced by an improved technique, showing the graphite in position. Ordinary photomicrographs show the cavity from which the graphite has been torn by the polishing process or the cavity filled with the polishing powder used. While this is satisfactory for ordinary routine examinations, the examination of the flake itself makes possible some fresh observations of great theoretical and practical interest.

The recommended methods for the sampling, analysis and microexamination of cast ferrous metals and alloys, issued by the Association in 1933, still hold good, but in a number of cases it has been necessary to modify or improve existing methods of analysis. Improvements which have been published refer to the determination of molybdenum in cast iron[1] and to the determination of aluminium.[2] The latter Paper is of great importance to those concerned with determining aluminium in cast iron. Work on the determination of titanium is in course of publication.

Non-Metallic Inclusions

The most important report published in 1936 related to the effect of non-metallic inclusions on the graphite size of grey cast iron.[3] This Paper dealt with the effects obtained by converting flake graphite irons into fine graphite irons of similar composition by treatment with a small quantity of titanium and carbon dioxide. The Paper aroused great interest in metallurgical circles at home and abroad, and the process is suitably protected for the use of members of the British Cast Iron Research Association. The change in the reverse direction can be made by treating the melt with hydrogen, so that it becomes possible to turn completely coarse graphite iron to fine graphite and back again at will. There are striking differences in the fracture, microstructure and foundry properties between the two types of material of identical composition. One of the remarkable features of this process is that it can be carried out on irons, irrespective of the carbon content, provided the carbon is below the eutectic value, as it is in most irons to-day. When it is remembered that efforts for many years towards improving cast iron have been directed towards diminishing the graphite size by diminishing the quantity of graphite itself, leading ultimately to low carbon irons not easy to cast and of high shrinkage, it is clear that a process which produces the smallest possible graphite, irrespective of the quantity of carbon present, must possess exceptional interest. The practical possibilities are not yet fully worked out.

An Inoculation Theory

In the Paper mentioned, the authors devised a theory to account for the refinement by supposing that, in the ordinary way, minute solid non-metallic inclusions in the melt at the moment of solidification act as nuclei for the deposition and growth of graphite flakes. It is known that titanium forms an extremely fluid slag, and it is supposed that under the influence of the oxidising gas low-melting titanium slags are formed, which envelop the particles. The fluid envelope is not capable of inoculating the melt, which therefore cools and solidifies at a lower temperature with the finer graphite. The difficulties of the theory are well recognised by its exponents, but it was sufficiently good to enable them to predict that copper might have a similar refining effect and this was found by experiment to be the case, but the complete Paper must be consulted for details.

It will naturally be understood that differences between fine and coarse graphite iron are most pronounced when the carbon is high. The importance of the Paper is due in part to the fact that many British pig-irons contain small quantities of titanium, and the work links up and makes clear a great deal of earlier work, in the course of which irons containing patches of fine graphite were produced without a clear apprehension of the reason. The presence of titanium was seldom known to or suspected by the makers of raw materials, pig-irons, refined irons and ferro alloys in use. A general account of this work and its earlier developments was given by the present writer to the International Foundry Congress at Düsseldorf in 1936.[4]

Ingot Moulds

In 1937 the first report of the Ingot Moulds Sub-Committee of the Iron and Steel Institute was published.[5] This comprehensive report dealt with the life of ingot moulds and includes the results of ordinary works practice, works tests, the results of examinations of works records, as well as experiments designed to place on record experience relating to ingot moulds. A prominent American works commented that " This valuable report was far more complete in respect to subject matter than any previous report on ingot moulds." The present writer contributed a Paper in this report on " The Failure of Ingot Moulds for Steel Ingots,"[6] prepared originally for the Ingot Moulds Sub-Committee in 1935 and dealing with crazing and cracking failures.

Foundry Coke

To the Institute of British Foundrymen's Annual Conference at Derby in June, 1937, Dr. H. O'Neill and the present writer contributed a Paper on " Foundry and Laboratory Characteristics of Cupola Cokes."[7] This Paper recorded probably the most comprehensive series of melting tests carried out in this country, on 17 different cokes, as a result of which the cokes were arranged in foundry order of merit in accordance with metal temperature and rate of melting. Some auxiliary experiments were made in a small cupola on special charges for carbon and sulphur pick-up tests. Practically all the known laboratory tests for coke were then applied to see what correlation could be established between foundry order of merit and laboratory results.

In dealing with a material obviously so dependent on the coal from which it is made and itself subject to all the variations of a natural raw material, it could scarcely be expected that very definite results could be obtained, particularly as production conditions made it difficult to try cokes which might have been bad enough to endanger the day's melt, but it is significant that several tests succeeded in picking out the cokes roughly in accordance with the order of merit, and the shatter index is recommended to be not less than 80 on a 2-in. mesh for a good cupola coke.

Wear and Lubrication

The present writer contributed a brief note on " The Wear of Cast Iron " to the Conference on Lubrication and Lubricants, organised by the Institution of Mechanical Engineers,[8] and Dr. A. L. Norbury, in a Paper on " Modern Views of Cast Iron,"[9] drew parallels between the change from coarse to fine graphite referred to above in cast iron and the change in the aluminium-silicon alloys produced by the use of modifiers. The similarity is so striking that the fine graphite irons are now often termed " modified " cast irons.

Reference should also be made to the important Paper by Dr. Gough and Mr. Pollard to the Institution of Automobile Engineers on

(*Continued on page* 38.)

Institute Activities in—

VITREOUS ENAMELLING

By

W. H. WHITTLE

Chairman, The Institute of Vitreous Enamellers

WHILST there has been a shortage of orders in some directions, on the whole business in the vitreous enamelling trades has been fairly steady, and there are signs of a better time ahead, particularly as the scope for this process of finishing is an ever-increasing one.

The demand for the new trade labels supplied by the Institute of Vitreous Enamellers has considerably exceeded expectations, which seems to suggest that the trade is anxious to show the advantages of vitreous enamelling over most other finishes. As long as the quality is kept to a good commercial standard, the outlet is bound to be still further extended, there being no other process that gives such a lasting finish at so low a price.

The Institute of Vitreous Enamellers was indeed fortunate in having induced Sir Harold Hartley, C.B.E., F.R.S., M.C., M.A., to serve as President for a further term. His assistance in various ways, and particularly on matters relating to research, is of unique value to the members.

The trade sign upon which so much time, thought, expense and energy has been expended, is now proving its worth.

Membership of the Institute is increasing, but not quite as fast as the Council would like, and a personal appeal is again made to the trade in general for those who are not members to give their consideration to both their company and members of their staff joining, as the greater the membership, the easier it will be for the Institute to proceed with educational and research problems.

The annual conference held in London in October was again most successful, and it is a source of great satisfaction that each year the meeting well maintains the very high standard which has been set, and which in the end is bound to be beneficial to the industry. The thanks of the Institute are due to the President, who took such a personal interest in the arrangements, and to the London Committee for the work they put into it.

Another point of advantage to members which ought to be stressed is the recent visit to some of the works in U.S.A. So hospitable were our American cousins that the Council have decided to extend an invitation for them to visit us, and we are hoping they will be able to make the trip to coincide with this year's annual conference and banquet, which has already been fixed to be held in September in Birmingham.

Five Years' Work

Below are summarised some of the most important objects that the Institute has accomplished since its incorporation in 1934 (these, incidentally, have been compiled by the Literary Committee of the Institute).

(1) It has procured a trade sign for the industry which is eminently adequate for preventing the misuse of the appellation "vitreous enamel" by competing interests not engaged in making the genuine article.

(2) It has sold more than a half-million of the labels evolved from the trade sign.

(3) It has issued large quantities of propaganda brochures in an attempt to popularise vitreous-enamelled goods.

(4) It has organised a series of technical meetings in Scotland, Manchester, Birmingham and London.

(5) It has published four volumes of Proceedings—the very basis of British technical literature of the industry.

(6) It has organised no less than 22 visits to works.

(7) It has been the avenue for visits to works in U.S.A., Germany and Belgium.

(8) It has co-operated with the British Standards Institution for the creation of acceptance specifications.

(9) It has now taken concrete steps to finance and participate in co-operative fundamental research for the industry.

(10) It already has a membership of over 200.

It is therefore suggested that all who are interested in the vitreous enamelling industry, and are not already members, should recognise the importance of the above facts, and if they think the efforts worth encouraging, to communicate with the Secretary of the Institute, Miss E. Christine Elliot, 42, Napier Court, Hurlingham, London, S.W.6, for particulars of membership.

In conclusion the author wishes the members of the Institute and the industry as a whole a happy, peaceful, and prosperous New Year.

RESEARCH

(*Continued from page* 37.)

"Properties of Some Materials for Cast Crankshafts."[10] This Paper gave a complete range of mechanical tests carried out at the National Physical Laboratory, including tests for combined stress, bending and torsion, such as crankshafts have to withstand in practice, on a group of five materials supplied through the British Cast Iron Research Association, and including an alloy cast steel, heat-treated; a low-carbon copper-chromium iron, heat-treated; a typical inoculated iron; a chromium-molybdenum iron, and a nickel-chromium iron, the last three tested as-cast. All these materials were either in use or under development for crankshaft purposes. The use of cast iron in the gas industry was discussed by the present writer in a Paper[11] to the Institution of Gas Engineers, with special reference to heat-resisting and corrosion-resisting materials. In a Paper to the Bradford Conference of the Institute of British Foundrymen in June, 1938, Mr. A. J. N. Smith, B.Sc., gave an account of the effect of copper in cast iron,[12] also dealt with by Mr. W. B. Sallitt in a Paper on "Copper in Cast Iron and Malleable Iron."[13]

High-Duty Cast Iron

Perhaps the most important report issued during the year[14] has been the first report of the Research Committee on High-Duty Cast Irons for General Engineering Purposes of the Institution of Mechanical Engineers, presented to that Institution in December. For the first time mechanical engineers, through their leading institution, had placed before them the developments of the past fifteen years in the metallurgy of cast iron, results on a series of materials actually produced by the industry in the ordinary way of business, and the first results of an investigation into the range of materials concerned. The Paper produced an excellent discussion, and the work is being continued.

To the Conference of The Institute of Vitreous Enamellers in November a Paper was presented[15] giving an account of various pieces of apparatus, chiefly developed and used in the U.S.A., for the scientific control of vitreous enamelling or for use in the preparation of frits, which can be applied with a minimum of trouble.

Space forbids extended reference to other developments, but mention may be made of the very convenient summaries of progress in malleable cast iron by Mr. H. H. Shepherd[16] and on cast iron in engineering construction by Mr. J. L. Francis,[17] while Mr. V. C. Faulkner gave some valuable statistical data relating to the industry to the Polish Foundry Congress.[18] Reference may also be made to the valuable work on the relief of internal stress by Mr. W. Machin[19] and by Benson and Allison,[20] and to the further work by Mr. E. Longden[21] on contraction. A Paper by Mr. B. MacDougall[22] on the results of experience on electric furnace melting is also of great interest, as is the Paper by Mr. J. Arnott[23] on the same subject. On sand testing the book by Mr. T. R. Walker[24] may be mentioned.

BIBLIOGRAPHY.

1 AUSTIN, E. T. "Determination of Molybdenum in Cast Iron." "Analyst," 1937, Vol. 62, February, pp. 107–117.

2 AUSTIN, E. T. "The Determination of Aluminium in Cast Iron." "Analyst," 1938, Vol. 63, August, pp. 566–592.

3 NORBURY, A. L., and MORGAN, E. "Effect of Non-metallic Inclusions on the Graphite Size of Grey Cast Iron." Journal of the Iron and Steel Institute, 1936, No. 2, pp. 327p–346p.

4 PEARCE, J. G. "Graphite Structure of Grey Cast Iron and Its Modification." Internationaler Giessereikongress, Düsseldorf, 1936, No. 5.

5 IRON AND STEEL INSTITUTE. First Report of the Ingot Moulds Sub-Committee. Iron and Steel Institute, Seventh Report on the Heterogeneity of Steel Ingots, Section 6, pp. 143–195.

6 PEARCE, J. G. "The Failure of Ingot Moulds for Steel Ingots. The Influence of Composition and Structure." Iron and Steel Institute, Seventh Report on the Heterogeneity of Steel Ingots, Section 6, pp. 184–193.

7 O'NEILL, H., and PEARCE, J. G. "Foundry and Laboratory Characteristics of Cupola Cokes." Proceedings of the Institute of British Foundrymen, 1936–37, Vol. 30, pp. 196–242.

8 PEARCE, J. G. "Wear of Cast Iron." Institution of Mechanical Engineers, General Discussion on Lubrication and Lubricants, 1937, Vol. 1, pp. 546–549.

9 NORBURY, A. L. "Modern Views of Cast Iron." FOUNDRY TRADE JOURNAL, 1937, Vol. 57, December 16, pp. 471–473.

10 GOUGH, H. J., and POLLARD, H. V. "Properties of Some Materials for Cast Crankshafts." Proceedings of the Institution of Automobile Engineers, 1936–37, Vol. 31, pp. 821–884.

11 PEARCE, J. G. "Cast Iron Research and the Gas Industry." Institution of Gas Engineers, Annual Meeting, 1938, June, Publication No. 183.

12 SMITH, A. J. N. "Copper in Cast Iron." FOUNDRY TRADE JOURNAL, 1938, Vol. 58, June 30, pp. 537–540 and Vol. 59, July 7, pp. 8–11.

13 SALLITT, W. B. "Copper in Cast Iron and Malleable Iron." FOUNDRY TRADE JOURNAL, 1937, Vol. 57, November 4, pp. 354–357, and November 11, pp. 379–380.

14 First Report of the Research Committee on high-duty irons for general engineering purposes of the Institution of Mechanical Engineers. December, 1938.

15 PEARCE, J. G., and MARTIN, G. T. O. "Scientific Aids to Control in Vitreous Enamelling." FOUNDRY TRADE JOURNAL, 1938, Vol. 59, November 3, pp. 333–336 and 338.

16 SHEPHERD, H. H. "Developments in the Production of Malleable Castings." "Iron and Steel Industry," 1935, Vol. 9, November, pp. 51–53; December, pp. 90–93; 1936, January, pp. 127–131; February, pp. 167–171; March, pp. 204–208; April, pp. 245–248; June, pp. 375–380; 1937, vol. 10, July, pp. 515–519; August, pp. 567–571; September, pp. 621–624; Vol. 11, October, pp. 35–38; November, pp. 47–51; 1938, January, pp. 122–126.

17 FRANCIS, J. L. "Cast Iron in Engineering Construction." "Iron and Steel Industry," 1938, Vol. 11, March, pp. 207–212 and 223; June, pp. 471–473; August, pp. 562–567; September, pp. 607–613; Vol. 12, October, pp. 17–22; November, pp. 181–184; December, pp. 207–209.

18 FAULKNER, V. C. "Some Notes on the Structure of the Foundry Industry of the United Kingdom." FOUNDRY TRADE JOURNAL, 1938, Vol. 59, October 6, pp. 249–250.

19 MACHIN, W. "Contraction Stresses in Castings. Methods of Stress Relief." "Iron and Steel Industry," 1938, Vol. 11, February, pp. 173–177.

20 BENSON, L. E., and ALLISON, H. "Relief of Internal Stress in Castings." FOUNDRY TRADE JOURNAL, 1938, Vol. 58, June 23, pp. 527–528, and June 30, pp. 543–544.

21 LONGDEN, E. "Design and Relationship to Contraction and Distortion." FOUNDRY TRADE JOURNAL, 1938, Vol. 58, February 3, pp. 115–118.

22 MACDOUGALL, B. "High-Duty Iron. Some Experiments with the Rocking Arc Furnace." FOUNDRY TRADE JOURNAL, 1937, Vol. 57, November 25, pp. 407–411, 412.

23 ARNOTT, J. "High-Duty Cast Iron." FOUNDRY TRADE JOURNAL, 1938, Vol. 59, December 15, pp. 447 and 450.

24 WALKER, T. R. "Foundry Sands, with Particular Reference to Steel Foundry Practice." 1938, London, Griffin.

Progress maintained in—

NON-FERROUS FOUNDRY PRACTICE

By

JOHN E. NEWSON

Chief Metallurgist, Manganese Bronze and Brass Co., Ltd.

THE past year has been a period of well-maintained activity for most non-ferrous foundries, and whilst there have been no startling developments to record, the general tendency for improved foundry practice continues. This tendency has developed during the past few years, and although at no time has it been spectacular or revolutionary, the application of fundamental scientific principles to foundry practice is slowly but surely replacing some of the older rule-of-thumb methods. It is not intended to imply that foundrymen are losing any of their traditional skill, but rather that the introduction of new alloys and new mould materials is stimulating the present generation to seek a wider knowledge of the science of their trade.

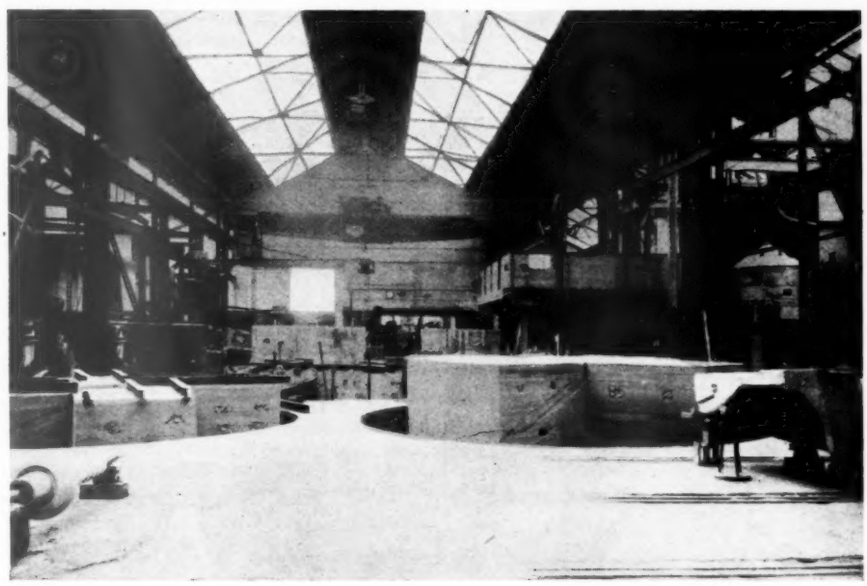


FIG. 1.—VIEW IN LARGE NON-FERROUS FO UNDRY, SHOWING RANDUPSON MOULDS AND SAND PLANT. THE CLEANLINESS AND LIGHTNESS OF THE SHOP IS NOTEWORTHY.

Following the advent and development of alloy cast irons there has undoubtedly been considerable extension of research work on the products of the iron foundry, but in the other field covered by the very general term "non-ferrous foundries," which handle such an extensive range of alloys, the progress has been no less remarkable, but has perhaps not attracted the same attention. This is not surprising, since a number of modern foundries incline rather to specialise on a restricted group of alloys, and it becomes increasingly difficult to keep pace with the advances of all the units making up the non-ferrous trade. Most large foundries now have their own research departments devoted to developing their own alloys and products, and the research associations are allocating considerable time to foundry problems.

Light Alloys

For example, the past few years have seen great strides in the casting of light alloys, both magnesium-base and aluminium-base, some of great complexity and requiring a high degree of skill in control, treatment and moulding technique, in the casting of aluminium bronzes and in the casting and treatment of nickel-bearing bronzes, to name but a few.

Some of these alloys respond to heat-treatment and for many special applications the extra cost of this heat-treatment is well worth while in view of the remarkable improvements in properties obtained. In a recent Paper presented to the London Branch of the Institute of British Foundrymen, Mr. F. Hudson drew attention to an interesting effect that the introduction of some of the heat-treatable nickel bronzes has had upon certain old-established brass-foundry alloys. To derive the maximum benefit from heat-treatment, the first essential is a sound casting, free especially from inter-dendritic cavities. This has led to a more intensive study of the problem and a more extensive application of the methods of ensuring soundness, not only to the special alloys in question, but also to the gunmetals and phosphor-bronzes which have been in use for years.

Such investigations have focused attention on the need for more precise control of melting conditions and atmospheres, and the benefits which accrue from the elimination of dissolved gases before casting. The need for such precautions with many non-ferrous alloys, particularly in the light-alloy field, has long been recognised, but the introduction of the bronzes containing nickel has certainly indicated the possibilities of improvement which may be expected in the older alloys.

The Randupson Process

Turning now from castings to mould materials, the past year has seen the growth of the Randupson process in several large non-ferrous foundries in this country. The process as developed in France, and applied later in the United States and this country, was originally used for iron and steel castings. More recently its use in all these countries has spread to the non-ferrous industry, and particularly for such large castings as marine propellers in high-tensile brass, but it has been applied with equal success to the casting of other metals, including aluminium alloys. A concise account of the process, setting out its advantages and disadvantages, was given by Mr. F. W. Rowe to the Institute of British Foundrymen's Conference at Bradford.*

As explained there, the process consists of the use of a silica sand, generally free from natural bond, to which controlled additions of Portland cement and water are made. The mixture can be rammed round patterns like an ordinary moulding sand, or strickled in a manner similar to loam. The moulds are reinforced with straight irons, and suitable lifting staples are bedded in where desired. When set, the moulds have considerable strength and the various parts are clamped together for casting without the use of metal box parts.

No drying stoves are required for the moulds, the strength of the mould being due to the set of the cement, the content of which may be varied to suit the size of mould or type of alloy to be cast. Moulds and cores are characterised by a remarkably high permeability. Old moulds can be broken down, and where a suitable sand plant is installed,† the recovered sand is screened and passed to a storage hopper. Thence it is measured out to the mixer, and with a much smaller addition of cement is used again as backing sand. The process obviously does not compete with green-sand moulding in view of the time required for the cement to set, which may vary from 24 hrs. minimum to 48 or even 72 hrs. on the largest moulds, but moulding times compare very favourably with large dry sand or loam jobs. This is due, in part, to the ease of ramming, since the sand flows readily and needs little compression. It can also be jolted or vibrated with equally successful results.

The *pros* and *cons* of the process were ably set out by Mr. Rowe, and a very full discussion followed the Paper, and it is not proposed to enlarge upon these here beyond emphasising one

(*Continued on page* 40.)

* FOUNDRY TRADE JOURNAL, Vol. 58, No. 1140, pp. 520-526.
† FOUNDRY TRADE JOURNAL, Vol. 59, No. 1155, p. 247.

There are enormous potentialities for —

LIGHT ALLOYS

By

W. C. DEVEREUX, F.R.Ae.S.,

Managing Director, High Duty Alloys, Limited

THE output of primary aluminium is greater to-day than it has ever been in the comparatively short history of the industry. It is only about fifty years since aluminium was first produced commercially but in this extremely short space of time its development has been so rapid that it now occupies a place of major national importance. The speed of development of this industry can only be rivalled by those of the automobile and aircraft industries. In Fig. 1 is shown the rise of production and consumption in this country, and it will be seen that in the past two years these have been considerably accelerated.

Further rapid increases in production capacity are expected in the near future, both from existing plant and from the new reduction works which are under construction in South Wales. Plant for the fabrication of the pure metal and its alloys is also being considerably increased, extensions have been made recently to practically all existing plant, and two new rolling mills have recently started full-scale production, while additional manufacturing facilities, including the new High Duty Alloys factory at Redditch, are nearing completion.

Although aluminium occupies only fourth place in the production of non-ferrous metals when considered on a weight basis, on a volume basis (which is a more suitable index of importance) aluminium is a close third after copper and zinc. In the figures for world output for 1937, aluminium production was 71 per cent. of copper output and 79 per cent. of that of zinc on a volume basis. Further gains will no doubt be shown by the 1938 figures when they are available.

It has been said, as a result of the set-back in world consumption during the slump of 1932, that aluminium is unduly sensitive to market conditions. It should be remembered, however, that the last slump came at a very critical stage in the development of the industry and it is felt that when the metal attains its true status, as it shows every sign of doing in the near future, this undesirable feature will be eliminated.

One of the chief reasons for the rapid rise of the aluminium industry, apart from the good specific strength properties of the metal and its alloys, has been its low price. It is not always appreciated that bulk for bulk, aluminium is cheaper than copper or lead.

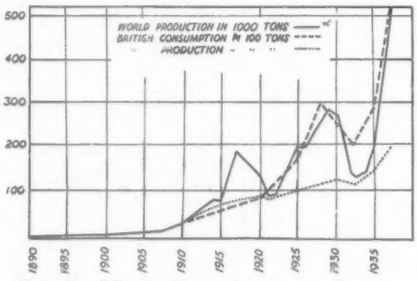


FIG. 1.—WORLD PRODUCTION AND BRITISH CONSUMPTION AND PRODUCTION OF ALUMINIUM.

Recently there has been a reduction in the price of aluminium, the first for over six years. The price of primary aluminium is controlled by international agreement and remains steady for considerable periods, as opposed to the day-to-day fluctuations in the price of other metals. Since 1926 the price in this country has been changed only six times. In that year the price of 99 per cent. pure aluminium was reduced from £118 per ton to £105, and in 1928 it was lowered to £95, and again in 1930 to £85. This price remained until 1931, when the British currency was devaluated and the price of aluminium was raised to £95 per ton, and again in September of the following year to £100 per ton. That price was maintained until July of last year when it was reduced to £94 per ton.

It cannot be denied that the accelerated production of the recent years is partly due to the rearmament programme, which has made considerable demands upon the industry and has persuaded a large number of firms previously engaged in other industries to take up the fabrication of aluminium and its alloys. It is, at the same time, certain that under pressure of the urgent demands of the rearmament programme, the normal development in other potential markets has been retarded. This fact may assume considerable importance as intensive development of these other fields of application will become vital when the demands for rearmament purposes are fulfilled, since it is into these

(*Continued on next page.*)

TABLE I.—*Production of Aluminium in* 1937.

	Metric tons.
U.S.A.	132,800
Germany	131,600
U.S.S.R.	45,000
Canada	42,600
France	34,500
Switzerland	25,000
Norway	23,000
Italy	22,900
United Kingdom	19,400
Other countries	13,800
Total	490,600

NON-FERROUS FOUNDRY PRACTICE

(*Continued from page* 39.)

or two aspects of its application to non-ferrous alloys. Castings have a surface finish equal, and in most cases superior, to ordinary loam castings, since there is an entire absence of fins or veins due to shrinkage of the loam in the drying process. A foundry laid out for the Randupson process presents an attractive, clean appearance (see Fig. 1), and there is no unsightly collection of box parts, which seem to be a continual eyesore in most foundries. The amount of tackle required for the process is not bulky, is generally detachable and convertible to a range of sizes and occupies far less room than old metal box-parts. For large foundries the considerable space occupied by drying stoves becomes available as moulding space or setting space.

It has been suggested in some quarters that the process may reduce the skill required by moulders. It is a fact that the sand in the green state has not such a good bond as normal moulding sand, and there is therefore not the same opportunity for the moulder to spend time "finishing" moulds. With a well-made pattern and the sand in the correct condition, there should be no necessity to interfere with the mould surfaces after stripping the pattern, save only in exceptional cases. In this sense, moulding becomes easier and less time need be spent on a mould and perfectly good true castings are produced. On the other hand, there are endless opportunities for the moulder to display his skill and ingenuity in the design and construction of moulds by this process. There can be little doubt that the Randupson process offers many attractions to foundries engaged on certain types of work, and when the class of output is such that the full benefits can be obtained from the use of cement sand moulding, its introduction will lead to increased production.

The period of continued activity has provided the stimulus for a number of foundries to overhaul their plants and install more modern equipment, and the tendency to introduce mechanisation either wholly or in part is becoming more marked.

Melting Plant

The present position with regard to melting is interesting, in that whilst coke and oil firing are still the commonest methods of melting non-ferrous metals, and the use of the electric furnace is growing, there is a revival of interest in the use of gas, and now that powdered coal is available in bulk, it is being used for firing large reverberatory furnaces. Powdered coal is delivered and handled in a manner somewhat similar to oil fuel, and with suitable burners it is safe, efficient, economical and very flexible in control.

To sum up, it may be said that in almost all directions progress in the non-ferrous foundries has been maintained throughout the past year. The visit to the U.S.A. organised by the Institute of Metals and the Iron and Steel Institute unfortunately did not materialise owing to the political situation. Visits to some of the largest non-ferrous foundries had been planned, which should have proved extremely interesting, and the cancellation of the visit provoked keen disappointment.

industries that the vast production and fabricating resources, now being built up, must eventually be diverted.

National Consumption Considerations

There is no doubt that there are more than sufficient potential civil markets for this production, and in this connection Tables I and II, which give figures for production and consumption in various countries, are of interest.

TABLE II.—*Consumption in* 1937.

Country.	Total consumption.	Consumption per head of population.
	Metric tons.	Lbs. (approx.).
U.S.A.	154,000	2.51
Germany	132,900	4·1
United Kingdom	49,000	2.42
U.S.S.R.	47,000	0.975
France	28,000	1.44
Italy	26,000	1.35
Switzerland ..	13,000	7.2
Other countries ..	51,800	—
Total ..	501,700	2.86 (average)

It will be seen that the U.S.A. and Germany head both lists while this country occupies ninth place among the producers and third place among the consumers, the chief imports coming from Canada, Norway and Switzerland.

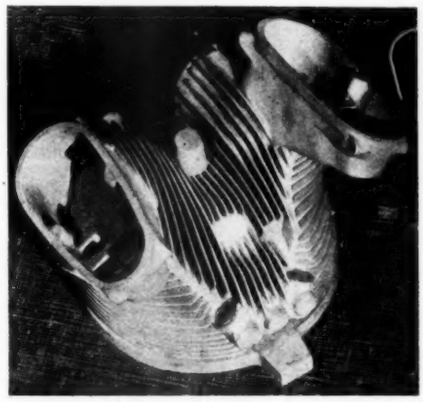
In the second column of Table II are given the approximate consumptions per head of population in the various countries, and it will be noted that consumption in this country is below the average. The highest proportional consumption occurs in Switzerland, in which country the first reduction works in Europe were established, and in which much of the development of the uses of aluminium has taken place. The next in the list is Germany, but the high consumption in that country is somewhat artificial, since in pursuance of the policy of self-sufficiency the use of aluminium, being a domestic material, is vigorously encouraged in place of the other non-ferrous metals which have to be imported. Undoubtedly, however, this policy has led to the discovery of an enormous field of application for this material.

The third largest proportional consumption is in the United States, where the pure metal and its alloys find very extensive application in practically every branch of life. It is in that country that most of the development of the application of aluminium alloys in large engineering structures such as bridges, drag line booms, etc., has taken place.

Thus it will be seen that the industry in this country has a long way to go before saturation point is reached in the consumption of aluminium, and considering the consumption in Switzerland and the United States there is no reason to expect a falling-off in demand with the curtailment of orders for rearmament purposes. The fact remains, however, that the aluminium industry is of very considerable strategic importance even if considered only from the point of view of the manufacture of aircraft and aero-motors.

Technical Development

The future of the light-alloy industry is so built up on research, and the possibilities are so great, that the industry should be spending at least 10 to 15 per cent. of its man-power on research development. The possibilities ahead of the light metal industry are so astounding and so definite that this money expenditure would be repaid a thousandfold. It is deplorable, however, when one considers the extent of the industry, how little is really being spent on research development, both for fundamental questions and on applications.



SAND-CAST CYLINDER HEAD FOR AN AIR-COOLED AERO-ENGINE, MADE IN "HIDUMINIUM" RR. 53.

In recent years, research has been accelerated by the urgent need for improved materials of construction and facilitated by the perfection of several new instruments which have permitted investigation of a more fundamental nature than was previously possible. One of the most important developments in the production of the primary metal in recent times is the process for producing "refined" aluminium of a purity of 99.9 per cent. and over. The availability of this metal on a commercial scale has opened up new fields of application.

Considerable improvement has been manifest lately in the mechanical properties of light alloys. Such development has resulted very largely from the demands of aircraft and aero-engine manufacturers for stronger and lighter materials and for alloys with higher mechanical properties at elevated temperatures. One of the most outstanding developments in this sphere is the relatively new alloy "Hiduminium RR.77" which has the highest mechanical properties of any light alloy available on a commercial scale. It has a minimum proof stress of 27 tons per sq. in., an ultimate stress of 33 tons per sq. in. and an elongation of at least 8 per cent.

A remarkable feature of recent "progress" in light alloys has been the "rediscovery" of alloys which have been known for years but whose properties have only recently been fully appreciated, or whose production on a commercial scale has only recently been made possible by new and improved manufacturing methods. Among such alloys are those developed from the Duralumin type of alloy, with which, by only slight variations of composition, it has been possible to obtain considerably increased properties.

Casting Alloys

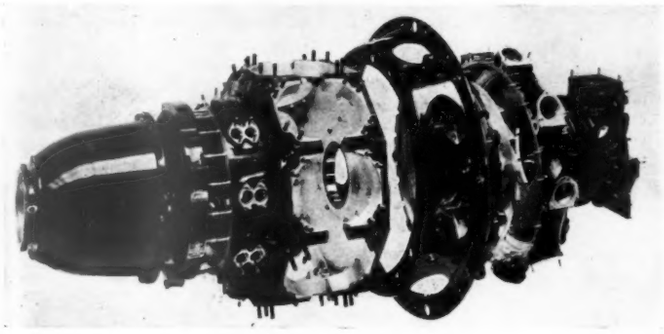
The casting alloys containing a comparatively high percentage of magnesium have also been known for a considerable time but they are only just being introduced in this country. Similarly, the Anticorodal type of alloy (Hiduminium 40, 42 and 45) has only recently been introduced here, although it has found very extensive application abroad.

It has been discovered that straight aluminium-copper (4 to 6 per cent. Cu) alloys are capable of age-hardening after a prolonged solution treatment. This type of alloy is now being developed for casting purposes and has been found to possess very good mechanical properties in the heat-treated condition.

Research is now being carried out both on aluminium and magnesium base alloys to discover a material which would give satisfactory results in the form of pistons for high-output aero-engines. The piston is a limiting factor in the development of high-power engines at the moment, and a material with high mechanical properties at temperatures up to 400 deg. C., combined with the other essential properties of piston materials, is very urgently required.

Wrought Alloys

The wrought aluminium-base alloys containing 8 to 15 per cent. of magnesium are another series which are being thoroughly investigated. These alloys have high mechanical properties and when



CRANKCASE ASSEMBLY OF THE BRISTOL PEGASUS, ILLUSTRATING THE USE OF LIGHT ALLOY COMPONENTS.

(By courtesy of the Bristol Aeroplane Company, Limited.)

Left to right:—Reduction-gear-case cover—RR. 56 stamping; front crankcase cover—magnesium alloy casting; front-half crankcase with valve gear cover—RR. 56 stamping; aft-half of crankcase—RR. 56 stamping; supercharger casing front-half—magnesium casting; rear half of supercharger casing—RR. 50 casting; auxiliary drive housing—magnesium alloy casting.

LARGE DIESEL-ENGINE PISTON CASTINGS IN "HIDUMINIUM" RR. 53. A MOTOR-CYCLE PISTON IS INCLUDED IN THE FOREGROUND TO AFFORD A SIZE COMPARISON.

carefully treated have a good corrosion resistance. There are still, however, considerable difficulties to be overcome in this direction and results so far have been somewhat disappointing.

Development on the production side is very closely allied with the development of new alloys, since many of these require an entirely new handling technique. Very great improvements have at the same time been achieved in the manufacture of the older alloys, and by this means it has been possible to effect improvements in the properties, quality and uniformity.

In the foundry one of the most interesting developments has been the introduction of low-frequency induction furnaces suitable for the melting of aluminium. These furnaces are considerably cleaner than the types previously used and the danger of contamination from the products of combustion is eliminated while control of melting conditions is greatly facilitated.

A very considerable interest has been displayed of late in the design of ingot moulds for the production of forging and extrusion billets and sheet slabs. A large number of patents have recently appeared covering various methods of pouring ingots, with a minimum of turbulence, by using a mould having a slit down one side through which the metal is poured. During pouring, the mould is lowered and the slit closed by various means so that the pouring spout remains at approximately the same level as the surface of the metal in the mould throughout the operation.

The continuous-casting processes are also receiving attention. By this means a very long length of ingot is cast and drawn through the bottom of the mould while casting is still proceeding, the required lengths being cut off as casting continues. Continuous-casting processes have now been developed for the direct production of strip and small diameter bars.

Sand Control

In sand and die-casting foundries, developments have been less spectacular and have been largely confined to improving running and gating methods, casting technique, and sand control. Undoubtedly the use of radiology as a routine method of inspection has had very decisive results in the foundry. In eliminating the causes of the defects revealed by this method, the foundryman has greatly improved the quality of the castings being produced; in this he has been aided by careful sand control and a better knowledge of the fundamental characteristics of the materials with which he is dealing.

Another very important point in sand-foundry practice has been the response to the foundryman's appeal for increased collaboration from the designer. Although this collaboration may not go quite as far as could be desired, there has recently been evidence of a decided trend in this direction.

The question of patterns still presents difficulties and it may take a long time to convince buyers that perfect castings can only be produced with perfect pattern equipment, which must necessarily be somewhat more expensive.

In the hot-forming of aluminium and its alloys development is even more rapid, but as this side of the question is not of so great an interest to readers of this journal, it need not be discussed herein.

Mention has been made above of the new tools which have facilitated the investigation of aluminium alloys. Perhaps the most outstanding of these is the apparatus for studying the crystalline structure by means of X-rays. By X-ray diffraction diagrams the constitution of many alloys has been investigated, and since the effects of all forms of heat, mechanical and chemical treatments manifest themselves in modifications of the arrangement of the atoms, X-ray methods are of inestimable value for the detection and analysis of such conditions.

The spectrographic analysis of light metals has now reached full commercial status, and the significance and effects of damping capacity are being investigated by means of recently developed equipment.

Applications

One of the most important applications of the pure metal is found in the manufacture of household utensils, in which market a very considerable amount of aluminium is absorbed. Another important use is the manufacture of steel-cored aluminium cable for overhead electric wires.

In aircraft, the high-strength alloys find their most important applications. The modern aeroplane is built almost entirely of light alloys, both fuselage and wings being composed of stressed light metal skin with extruded stiffening members. The use of castings is being increased in this field, as it has been found that by the use of X-ray inspection, a very high standard of reliability can be ensured from such parts. In the aero-engine also, aluminium alloys form the most important single material; recently-published figures show that light alloys constitute between 47 and 53 per cent. of the total weight of an aero-engine.

The aircraft industry is at the moment the largest single customer for high-strength alloys, and it is true that so far as this country is concerned this output is chiefly for rearmament purposes, but it is also a fact that the urgent demands for military aircraft are being satisfied largely at the expense of the civil market both here and abroad, and it can reasonably be expected that when production of military aircraft slackens off the demands of civil aviation will compensate to a large extent for the decline in military orders.

In other fields the potentialities are enormous. There are accounts from America of the extensive uses to which aluminium alloys are being put in the building of bridges, cranes, draglines and other large structural applications, of the considerable applications found for light alloys in every form of transport, and of the extensive uses of aluminium in architecture and decoration.

In Europe there are wide applications in the dairy industry and in naval architecture, and the use of aluminium as an alternative material for thousands of miscellaneous applications.

In this country, while the industry is undoubtedly in the front rank in respect of technical development, it is a very long way behind in appreciation of the vast field of application for aluminium and its alloys. The respite given by the present conditions has been profitably spent, and the potential applications have been thoroughly studied, so that when the time comes, these markets may be thoroughly exploited.

WORLD'S PIG-IRON and STEEL OUTPUT

THE subjoined table gives THE FOUNDRY TRADE JOURNAL'S estimates, based on the latest available data, of the outputs of pig-iron, including ferro-alloys, and of steel ingots and castings of the principal producing countries of the world during 1938, and estimated figures for the world outputs of these primary products in the same year. The corresponding final figures for 1936 and 1937 are also included to provide a comparison and to indicate the anomalous trend of iron and steel production in various countries during a very abnormal year.

The figures given in the subjoined table speak for themselves, and bring out the full force of the recession in demand experienced during the year. World pig-iron output receded by just over 20 per cent. and steel production by nearly 20 per cent. as compared with 1937, both figures being substantially below the 1936, and also the 1929, totals. German totals were, as stated above, much above those for the preceding year, not only owing to the marked expansion in home demand for iron and steel, but also as a result of the inclusion of the Austrian iron and steel industry from March onward. In Great Britain, there was a 20 per cent. recession in pig-iron output and an 18 per cent. reduction in steel output, while the United States, with a 50 per cent. fall in pig-iron production and a 45 per cent. reduction in steel output, is mainly responsible for the relatively poor showing of the world figures during the past year.

Estimated World Output of Pig-Iron and Steel in 1938 *compared with* 1936 *and* 1937. (*In* 1,000 *tons of* 2,240 *lbs.*)

Countries.	Pig-iron, including ferro-alloys.			Steel ingots and castings.		
	1936.	1937.	1938. (Estimated).	1936.	1937.	1938. (Estimated).
European.						
Great Britain	7,721	8,493	6,778	11,785	12,984	10,570
Germany	15,061	15,706	18,500	18,910	19,535	22,700
Austria	244	383		412	639	
France	6,131	7,807	5,866	6,602	7,795	5,991
Belgium	3,157	3,782	2,390	3,123	3,808	2,220
Luxemburg	1,955	2,473	1,520	1,950	2,471	1,428
Czecho-Slovakia	1,122	1,649	1,200	1,514	2,281	1,700
Iceland	575	710	877	1,123	1,430	1,450
U.S.S.R.	14,090	14,290	14,710	16,080	17,543	18,100
Italy	815	848	900	1,920	2,054	2,300
Sweden	621	682	675	962	1,088	950
Spain	350	190	200*	464	170	280*
Other Countries.						
United States	31,029	37,127	18,700	47,768	50,569	28,100
Canada	747	979	750	1,078	1,352	1,150
Australia	783	850	895	750	900	940
British India	1,543	1,629	1,600	866	895	956
South Africa	198	272	292	298	322	345
Japan, including Korea and Manchukuo	2,824	2,760	2,550*	5,283	5,720	5,280*
World total, including other countries	90,260	102,050	80,000	122,100	133,280	107,000

* Very doubtful.

There is an ever-broadening field in the industry for—

NICKEL and its ALLOYS

By

ROBERT C. STANLEY

Chairman and President, International Nickel Co. of Canada, Ltd.

WORLD consumption of nickel in all forms during the first ten months of 1938 amounted to approximately 168,000,000 lbs. This is a decrease of some 16 per cent. from the 1937 record of 201,000,000 lbs. for the same period, and is comparable with the consumption rate in 1936. The decrease in tonnage consumed was due largely to the abrupt drop in business in the United States during the last half of 1937 and the first half of 1938. However, estimates of United States consumption for the second half of the past year indicate a definite improvement in this important market, which normally takes half the total output. European and other markets continue to be relatively steady.

Although this is the first recession in an advance which began in 1932 (when the ten-months' figure was 27,500,000 lbs.), the percentage drop in nickel is believed to be considerably less than that experienced by world business as a whole. The uses of nickel have become so woven into the fabric of world industry that its consumption necessarily rises and falls with the tides of general business. At the same time, the pioneering in new uses of nickel and nickel alloys by the more active branches of industry cushions the fall in total consumption of the metal.

The series of international crises and the continuance of major conflicts both in Spain and in the Far East marked 1938 as a year of feverish preparation for war concurrent with a world-wide business recession which was especially severe in the United States. The net effect on nickel consumption in the principal industrial nations, which is contradictory to popular assumption, is discussed in a later section of this survey.

At the same time, however, important advances were made in the metallurgy and applications of nickel, despite the concentration on war and preparations for defence, and the following outline of developments in various branches of industry throughout the world indicates the extent to which nickel has become an industrial metal. Of interest in this connection is the growing activity among the metallurgical industries of South America. Use of nickel as an alloying element in castings has made substantial strides during the past two years, particularly in castings for mining, railway and petroleum equipment. The peoples of Latin America are already familiar with nickel through their use of cupro-nickel coins, of which 58 denominations have been issued to date by 19 countries.

Nickel in the Motor-Vehicle Industry

World production figures of motor vehicles during the first ten months of 1938 are not yet available, but indications are that the production in England will show a moderate reduction. In France it may equal or exceed slightly that for the same period a year ago. Production in the United States and Canada during the first ten months has been the lowest of any year since 1933, and amounts to approximately 44 per cent. of the similar period in 1937. This production is below replacement needs and, statistically, should indicate a potential demand for the coming year.

In England and France, the position of nickel-containing steels has been maintained, and, in some cases, higher nickel contents are being introduced to meet exacting service requirements. The industry in this country consumes large quantities of 1 per cent. nickel case-hardening steel in place of the plain carbon steel used hitherto for such parts as gudgeon pins and camshafts. The main reason for this change is that nickel steel possesses a better tensile strength and has a more consistent and higher shock resistance than plain carbon steel. There has been an increase in the use of nickel austenitic steels for exhaust valves, the nickel content ranging from 8 to 20 per cent., and 14 per cent. nickel being a favoured composition.

ESTIMATED WORLD CONSUMPTION

Although the final figures for the year may show minor variations, the following percentages give a general picture of the various forms in which nickel entered world industry in 1938:—

	Per cent.
Steels (constructional, stainless and other corrosion- and heat-resisting steels, and steel castings)	60
Nickel cast iron	3
Nickel-iron alloys	1
Nickel-copper alloys and nickel-silvers ...	14
Nickel brass, bronze and aluminium-alloy castings	2
Heat-resistant and electrical-resistance alloys	3
Monel, malleable nickel, nickel-clad, Inconel	9
Electrodeposition	6
Non-metallic materials for the chemical industry (nickel salts, ceramic materials, storage battery materials and catalysts)	1
Miscellaneous and unclassified	1

The significance of corrosion as an important factor in the wear of automobile cylinders has been demonstrated by research work in this country, and consequently interest in the use of corrosion-resisting Ni-Resist cast iron for cylinder liners is growing to such an extent that more than one foundry has had to consider expanding its facilities in order to meet the growing demand. Another increasing application of Ni-Resist is for exhaust manifolds.

The problem of eliminating piston-ring groove wear in light-alloy pistons has been largely overcome by using a carrier insert of Ni-Resist iron which matches the expansion properties of the aluminium alloy. This type of piston construction is increasing in popularity in the United Kingdom, and at the present time some forty engine builders either are using these pistons as standard or are experimenting with them. The range now being manufactured includes those of small Diesel engines with cylinder bores of 3 in. up to those for engines with cylinder bores of 9½ in. diameter. Besides the elimination of wear, this construction is overcoming trouble with rings sticking, a common fault in modern high-speed Diesel engines.

Efforts to economise by using nickel-free steels were reported from France to have resulted in a loss in dependability and a consequent return to the nickel steels. The high cost of petrol there has stimulated the demand for gas-driven trucks and lorries. Compressed gas is carried in cylinders of nickel-chromium-molybdenum steel to improve the strength-to-weight ratio.

The Society of Mechanical Engineers of Japan have published a survey of the materials used for automobile engine parts in that country. Of 34 kinds of cylinder liners for internal-combustion engines manufactured in Japan, nickel-chromium cast irons are being used for 24. Of 41 kinds of pistons, seven are of the nickel-aluminium-alloy-type materials, four are nickel-chromium cast iron, three are aluminium-silicon-nickel alloy and one is nickel-aluminium-copper alloy. Thirty-two kinds of piston rings for internal-combustion engines include four of low nickel-chromium iron.

In the U.S.A., as well as in other countries, the use of high-grade nickel-alloy steels in buses, lorries and tractors continues, and in several cases has shown an increase in the amount of nickel per vehicle. In all heavy-duty units, both petrol and Diesel types, the use of nickel cast iron continues for cylinder blocks, heads, liners, pistons, brake-drums and exhaust manifolds. Under conditions of high-temperature operation Ni-Resist is employed for manifolds. In some cases 20 per cent. nickel Ni-Resist is being used, and at least in one case the nickel content has been increased as high as 30 per cent. with 5 per cent. of chromium to obtain the necessary heat-resisting properties.

Railway Applications

The centenary of the opening of the London-Birmingham main line, which was celebrated in September, focused attention on the developments which have taken place in railway locomotion during the century. Typical of the modern power units now operating in this service are the "Duchess" class of 4-6-4 Pacific locomotives, in which nickel steels have been used for boiler plate, connecting and coupling rods and valve motion. These locomotives regularly haul heavy passenger trains the 110 miles from London to Birmingham in one hour and fifty-five minutes, making two stops *en route*.

Two experimental turbine electric units now under construction for an American railway system have underframes of a nickel-vanadium cast steel, and a copper-nickel alloy steel is extensively used in other parts of the construction.

Electrification is a pending problem for most of the Japanese railways, and electric locomotives are being generally considered. Qualification tests for the resistance grids include a severe drop test. To provide satisfactory electrical pro-

perties and at the same time meet the physical tests, the grids are being made of a special alloy cast iron containing from one to two per cent. of nickel.

Expanding Uses for Aviation

The year 1938 was marked by rapidly increasing aircraft production throughout the world. Nickel has always been the fundamental alloying element for steels subject to wear, as well as for highly stressed parts of aircraft engines. This role continues unchanged. Straight nickel steels and nickel-chromium, nickel-molybdenum and nickel-chromium-molybdenum steels with nickel contents up to 5 per cent. remain the standard materials for gears, connecting rods, crankshafts, cam rings, piston and knuckle pins, and numerous other important parts. The use of these materials not only assists manufacturers to obtain reliability but also makes possible low weight-to-horsepower ratios without sacrifice of safety.

This latter consideration is particularly pertinent in the face of a steady drive for increased horsepower per cylinder and per engine. Radial high-power engines, formerly confined in the main to nine cylinders in a single row, are now manufactured with fourteen cylinders in two rows, with maximum power for take-off up to 1,500 h.p. Liquid-cooled engines of similarly high rating with in-line cylinders are also in regular production. Naturally, the handling of such tremendous power requires materials of the highest quality.

Among the vital parts of an aircraft engine are the valves, and nickel-chromium steels containing 12 to 16 per cent. of nickel are standard materials for this application. Frequently the valves are sodium-filled for cooling and are nitrided on the stems for wear resistance.

The low weight per horsepower of the present high-powered engines is partly due to the use of aluminium-alloy pistons and cylinder heads. To improve the strength of these alloys at the relatively high temperatures at which they operate, compositions containing 1 to 2 per cent. of nickel are generally employed.

Interesting developments leading towards increased applications of nickel alloys have taken place in connection with the planes themselves. In recent months such giant planes have appeared as the 30-passenger 20-ton Boeing "Strato-liners"; the 42-passenger 30-ton Douglas "DC-4"; the 72-passenger 40-ton Boeing Clipper Ships; the British "Empire" flying boats, and several others of similar proportions. In the construction of planes of these sizes high-strength steels are required for such structural components as under-carriage parts, landing gear and fittings in order to keep their size down to a reasonable degree while still affording adequate strength. To meet these conditions nickel alloy steels have been widely used with entire success. Nickel-chromium-molybdenum steel in both forgings and castings has been a particular favourite as it provides a superior combination of strength, toughness and ductility.

A relatively small tonnage of cast iron is produced annually for aircraft engines, the cylinder castings usually being made of a high-strength nickel-molybdenum or nickel-chromium cast iron. Prospects for extending the use of high-grade cast iron in this industry are developing in the effort to produce a low-cost engine of sufficient power to appeal to popular demand. From France come reports of an outstanding achievement in aircraft engine cast iron, in which high-strength cast iron, rich in nickel and manganese, is cast in a toughened condition, so that the air-cooling fins are not brittle. After machining, an ageing or tempering treatment is applied to provide sufficient hardness and wear-resistance.

Development of cadmium as a base of bearing alloys has been rapid in recent years. To fit this metal for bearing service it is necessary to harden it with small quantities of another element, and the most satisfactory metal so far found for this purpose is nickel. Nickel-containing cadmium bearings have been standardised by one of the leading British aero-engine manufacturers for all the high-duty bearings.

Some New Uses in Shipbuilding

Because of the eternal problem of corrosion which is associated with all phases of ship operation, recognition of the corrosion resistance which nickel possesses, and which it can impart to other metals with which it is alloyed, is the stimulus for an ever-widening use of nickel in building, powering and outfitting ships of all classes.

Cast Monel impellers for pumps handling either salt or fresh water on board ship are being more widely used than ever. Storage tanks for boiler-feed water are of Monel to avoid contamination of the water by rust, and to permit of lighter weight construction by eliminating allowance for thinning through corrosion in service.

Anchor chain, both cast and forged, is now more commonly made of nickel steel, 3½ per cent. nickel steel being used for the forged chain and a nickel-chromium-molybdenum composition for the cast.

Mining

In the crushing, milling and classifying of ores progress has been substantial. Ni-Hard cast iron is showing in sand pumps two and a half to three times the life of plain white iron. In liners a similar range of improvement is found over white iron, and in other cases this alloy cast iron excels the performance of wear-resisting steel.

Related industries which employ nickel and nickel-chromium alloyed cast irons for abrasion-resisting purposes include ceramics, glass and cement. A sharp increase in the consumption of Ni-Hard in the ceramic industry was developed during the year as a result of its performance in tests which have progressed during the past several years. Cases have been reported where muller tyres used in the clay working industry have lasted from four to six times longer, when made of Ni-Hard, than the white iron previously used. Similar improvements in augurs, dies, shutes and liners have built up a demand in the industry for wear-resisting nickel-chromium alloyed iron castings.

The economy of nickel alloy white-iron grinding balls has been successfully demonstrated in many of the larger gold mining plants in Ontario and Quebec. In the western United States extensive field tests, in which approximately 300 tons of balls were consumed, indicate that this application will provide an increasing outlet for nickel.

In addition to the abrasion-resistant applications in which Ni-Hard is used, nickel is employed in grey irons for sheave wheels and gears. In smelting practice, nickel-chromium irons have shown improved characteristics for parts operating at elevated temperatures, such as the lute rings and rabble arms of roasters, and the grate bars of Dwight-Lloyd sintering machines.

Stainless-steel castings of the 18-8 type, both with and without molybdenum, are used in pumping installations handling extremely corrosive mine waters in copper mines. Stainless-steel castings of this type are also used in sulphuric-acid plants which are operated in conjunction with copper smelters. Cast nickel steels containing 1½ to 2 per cent. of nickel are being used for such widely diversified services as the rakes of classifier blades and the "dump arms" which hold the rock drills to column machines. There has been an increase in the use of nickel in austenitic manganese steel. This permits welding and causes retention of toughness at low temperatures.

Chemical and Process Industries

A practice has been developed in connection with the furnishing of corrosion-resisting rolls by applying a welded sheathing of nickel, Monel or other nickel alloy over a tube or casting of some other material. This method of roll covering is adaptable to the salvaging of old rolls as well as to the manufacture of new ones. A typical example is the use of Monel-covered steel lehr rolls in the glass industry, an application that has increased appreciably during the past year.

Noteworthy improvements in the quality of Monel, nickel and Inconel castings have been accompanied by a steady increase in the use of these materials in cast form by the process industries. A common application is for pump parts. There has been a greatly-increased use of Monel to resist corrosion by hydrofluoric acid and related compounds. Most of the applications have been in connection with the frosting and etching of glass, although there have been others in processes for refining lead electrolytically, in the manufacture of acid fluorides used for laundry service, and in the pickling of cast iron and steel.

During the past few years many chemical plants handling caustic solutions have discovered the advantages of relatively small amounts of nickel in increasing the resistance of cast iron to corrosion by strong alkalis. One of the problems which confronts the manufacturers of caustic soda is that of obtaining economical service from the large cast-iron pots used in the final stages of manufacture of solid caustic. Pots made of nickel and nickel-chromium compositions have been found to offer considerable improvement over ordinary cast iron as regards length of serviceable life and contamination of product. A composition widely used in Europe is 2 per cent. nickel with 0.75 per cent. chromium; in the United States the alloy iron pots usually contain about 3 per cent. nickel with 1 per cent. chromium.

Extension of the fields of application of viscose rayon fibres has been accompanied by greater need for control of the properties of the product. This, in turn, has led to a wider use of corrosion-resisting materials, principally nickel, for the handling of the viscose solutions and the chemicals employed in viscose processing. For the large plate and frame presses in which the viscose solutions are filtered, it has been found that copper-free Ni-Resist is an ideal material. While the use of Ni-Resist plates in cast-iron presses confers some advantage, best results are obtained when the whole press is made of Ni-Resist.

In the coal-gas industry in this country considerable use is made of exhausters and boosters for handling gas, and the design and conditions of service of such castings as the rotors and "slants" employed in this type of equipment demand high wear-resistance and uniformity of structure in massive sections. By standardising on 2 per cent. nickel: 1.0 per cent. chromium and on 1.5 per cent. nickel: 0.5 per cent. chromium compositions of cast iron for these components, one well-known manufacturer has been able to obtain the desired properties and reports satisfactory results in actual service.

Pulp and Paper Industry

Zinc-chloride solutions are used for converting paper into fibre such as is used as an insulating material. The excess zinc chloride is squeezed out of the paper by passing it between rolls which are subjected to corrosion by the zinc chloride. Ordinary cast-iron rolls have been found to be unsatisfactory, and Monel-covered cast-iron rolls are providing a solution to this corrosion problem.

Manufacturers of sulphite pulp have, in the past, been the principal users of corrosion-resisting materials. More recently the producers of Kraft (sulphite) and soda pulp have begun to realise the advantages of more durable

materials, thereby extending the use of nickel alloys, including Monel, the chromium-nickel stainless steels, Ni-Resist and nickel cast iron. Typical applications are digester fittings, diffuser bottoms, cooking liquor heaters, black liquor evaporator tubes, pumps, piping, valves and fittings.

Grade H cast Monel is used for the impellers, casings, suction heads and stuffing boxes of pumps handling mixtures of black liquor and sodium sulphate. A similar application is the use of Monel pumps with sulphate process green liquor.

Nickel-chromium alloy chilled-iron rolls of the Ni-Hard type have been increasing in favour in Europe, the United States and Japan for calender rolls, and especially in connection with the water-finishing process where ordinary chilled-iron rolls have proved inadequate both mechanically and from the standpoint of resisting deterioration by corrosion. In a typical case it was found that the alloy-iron rolls required repolishing only after six to twelve months' service, whereas ordinary iron rolls had to be redressed at least once a month. In addition to the alloy chilled-iron calender rolls, there have been installed some hardened alloy steel calender rolls containing about 3 per cent. of nickel.

Steam-Generation Plant

Nickel and nickel-chromium alloyed cast irons strengthened their position as materials for firebox and stoker parts of steam-generating equipment designed for power-station service, and Ni-Hard and abrasion-resisting cast irons of lower alloy content were used for coal-pulverising and ash-handling equipment. An instance was reported of ash-handling pumps made of Ni-Hard, which delivered approximately 73,000 tons of ashes before destruction, as compared with an 11,000-ton maximum for a wear-resisting steel previously used.

Agricultural Machinery

The plough, perhaps the oldest of farm implements, is still an object of considerable experimentation, some of which involves changes in material. The successful use of a high-carbon, nickel-chromium oil-hardened steel for disc ploughs has led to a trial of this material in the share of mould-board type, and extensive tests are under way. A report from France indicates a need for better wearing ploughshares at a low cost, and the manufacturers are interested in a nickel-chromium iron for hard facing to eliminate excessive wear.

Nickel cast iron has been used extensively for gears, sprockets, ratchets and stressed frames in the production of potato diggers, silo fillers, combines, mowers and hay balers. During the year several cream-separator manufacturers adopted 18-8 stainless steel for separator discs, bowls and shafting.

In both the old and new models of agricultural tractors nickel irons continue to be used for various motor and mechanical parts. Heads, blocks and liners are cast of nickel-chromium and nickel-chromium-molybdenum iron. Nickel-chromium and nickel-molybdenum iron are favoured for small single-throw cast-iron crankshafts in the tractor lawn-mower.

In order to overcome cracking and heat checking, one of the tractor companies adopted a nickel-chromium cast iron for exhaust manifolds with gratifying results. Heat-treated nickel-chromium cast-iron replaceable motor liners are quite generally used, and one company not employing this type of liner is contemplating its adoption to increase resistance to wear. Another leading producer has replaced plain iron with a nickel-chromium-molybdenum cast iron in the power-lift worms used in most of his models, with the result that wear resistance has been considerably increased and breakage formerly experienced has been eliminated. A change from plain iron to a nickel-chromium iron for ring gears employed in the building of tractor lawn-mowers for one of the leading mail-order houses in the United States was made during the year.

Armaments

The policy on the part of many nations of mobilising their populations and productive facilities for war purposes had an inevitable effect on the consumption of metals, including nickel. By reason of a growing interrelation between industrial activities and military preparedness, it is difficult, even in the British Empire or the United States, to trace with any exactness the flow of nickel into armaments. Nickel is used, together with such other metals as chromium and molybdenum, as an alloying element in the construction of artillery and armour-piercing projectiles, and of protective armour plate. In small arms—machine guns, rifles, bayonets, bullets and hand grenades—nickel is by no means a necessity; in fact, its use in this field is small and steadily decreasing.

The best available figures for Great Britain and the United States (the only countries for which there are current data) indicate that the total tonnage of nickel going into armaments in these two nations was approximately 5,000 tons in 1938, as compared with about the same tonnage in the previous year. In other words, in a year when rearmament was actively going on, the amount of nickel used for armaments remained almost the same as in the previous year, although consumption of nickel for all purposes dropped in these two markets to 70 per cent. of the 1937 figure.

Thus, it would appear that organisation for war has had a depressive rather than a stimulating effect on *total* nickel consumption, since the loss which results from the dislocation of normal industrial routine is in no sense compensated for by the tonnage consumed in armaments.

Machine Tools

The machine-tool industry depends in large measure for its activity on that in the fields of mass production. During the past two years rearmament programmes have been the most important factor, having contributed to maintaining a normal (1926) level last year despite the sharp drop in demand from United States industries, and to having established in 1937 a peak 35 per cent. above normal.

Factors increasing the use of nickel in machine tool construction have been the replacement of gear trains with hydraulic controls, and the growing practice of using materials for all components, which will assure as long a life for all parts as for the machine itself. Mass production is so organised that the immobilisation of a single unit for repairs seriously affects the whole production line; and, as a result, wear and breakage of parts have been virtually eliminated. Alloy cast irons and wrought steels containing nickel are playing an important rôle in this improved design.

The greatest value of nickel for cast-iron parts is its ability to assure uniform structure. Low-silicon irons are generally employed for the major components, such as hydraulic head castings, in order to eliminate internal shrinks in heavy sections and provide a close grain on machined surfaces. Nickel additions ensure satisfactory machinability in the lighter sections without affecting the quality of the iron in the heavier sections. A recent survey of the machine-tool industry in the United States indicates that 67 per cent. of the leading producers employ nickel cast iron, and 83 per cent. use nickel steels, for major components.

Building Construction

Nickel silver has continued to hold a leading position where white metal is desired for exterior ornament in modern building construction. Architects have turned to this white alloy because of its chromatic possibilities and attractive sheen, which makes it especially suitable for combination with bronzes and wrought-iron fittings, and also because pleasing effects can be developed with non-metallic materials such as terrazo, stone work, wood panelling and glass.

Nickel-containing alloys continue to be recognised by the United States Supervising Architect for ornamentation in building construction and for building equipment where appearance is an essential factor. Nickel silver has been specified currently, as shown in the metal ornamentation on medium-sized post offices. Stainless steel of the 18-8 type has also been specified. Specifications of the United States Government for plumbing fixtures are being revised to include metal sinks of both Monel and 18-8 stainless steel.

Monel range boilers and hot-water heaters are being supplied to various Army posts where water conditions are known to be corrosive. Large quantities are required for the new building programmes for officers' quarters. Ni-Resist has been adopted for tops on oil-burning ranges. Tests have been instituted for coal- and wood-fired ranges.

Air-Conditioning

Air-conditioning, refrigerating machinery, compressors and small engines continue to employ nickel alloyed cast iron compositions in much of their wear- or corrosion-resisting parts, such as cylinder heads. Cams and gears are built of the wear-resisting compositions, and connecting rods and, in some cases, frames are built of the high-strength types of nickel alloyed cast irons. Pumps and compressors in apparatus operating at low temperatures utilise to advantage the effects of nickel in toughening cast irons and maintaining in them their normal temperature properties. Nickel-molybdenum cast-iron cylinders, in the case of a popular air-conditioning unit, are estimated to possess sufficient wear resistance to deliver at least forty years of household service. This industry, it would appear, operated in the range of 50 per cent. of its 1937 rate.

Stainless Steel

The year 1938 was for stainless steel one of consolidating position. Production was below that in 1937, but quite satisfactory when compared with the production of the steel industry as a whole or even with the figures for general business.

Metallurgically, an important development has been the progress made with additions of titanium, niobium and molybdenum. The first two improve resistance to intercrystalline deterioration and ensuing corrosion; in consequence the welding of stainless steel is now an easier problem to handle. Molybdenum improves the standard 18-8 stainless steel and increases its corrosion resistance. Its use as an auxiliary alloying element to chromium and nickel is growing rapidly.

In the face of efforts to substitute a cheaper alloying element, such as manganese or copper, the trend is towards higher nickel content. Many alloys sold under the broad designation of "18-8" actually contain 10 per cent. or more of nickel, an example being the 16 per cent. chromium, 13 per cent. nickel, 3 per cent. molybdenum composition developed for use in seamless tubes for oil refineries and similar applications. The addition of niobium and molybdenum encourages a higher nickel content to ensure an austenitic steel.

The casting of stainless steels has been much improved in the past year, and the proportion of cast to rolled products has increased. The foundries particularly are leaning toward higher nickel contents.

Nickel Cast Irons

With industrial activity falling off throughout the world, and by more than 50 per cent. in the United States, a recession in nickel consumption by cast-iron and brass foundries was inevitable.

(*Continued on page* 46.)

How international armament reacted on—

The NON-FERROUS METAL MARKETS

By

OUR METAL EXCHANGE CORRESPONDENT

IN many ways the year just ended was probably the most dangerous and difficult since the Great War, and at the beginning of 1939 all we can say is that hostilities have been averted and that the world is hoping for better times ahead. The aftermath of the price collapse in 1937 followed us into 1938, and for the most part trade dragged rather badly for, at any rate, the first six months, and even the autumn did not bring much improvement. It is, however, satisfactory to note that in the United States the tide has turned and is flowing in the direction of a recovery, a factor which cannot fail to influence things for the better over here. Britain is busy on armament work, but other classes of business are not so good, and the possibility of higher taxation in the near future certainly does not help matters. Traders not unnaturally are holding back and there is a disposition to cut down fresh commitments to a minimum, but consideration of the events of 1938 leads to the conclusion that in this matter they can hardly be blamed for acting cautiously.

Actually, the great political events and international repercussions of last year did not have so much effect on the metal markets as one would have expected. Mr. Anthony Eden's resignation in February and the difficulties over Italy, followed by the Austrian *coup* in March, did not disturb commodities to any great extent, although momentarily values may have been marked down rather sharply. It must, of course, be remembered that at the back of most of the troubles during 1938 was the ever-present threat of war, and this served to keep prices up, for holders were not ready to let go with the prospect of a greatly increased demand before them. As the armaments race quickened, all the governments concerned appeared in the market as buyers, first of one metal and then of another, but the quantities taken varied a good deal, and it was not realised perhaps at the time how much of this metal was destined to be put into stock in the form of reserves.

Throughout the year just closed the principle of controlling production was observed in copper and tin by means of properly agreed schemes of output control, but in lead and spelter the same degree of success was not in evidence, and it would not seem that there is much chance of fixing up any really efficient zinc cartel. Speculation has been in evidence, but not to anything like the extent it was in 1937.

COPPER

The year opened with a good deal of pessimism about the copper position in the United States, for, although the primary producers were holding for 11 cents, business was passing at a much lower level, since the Custom smelters were prepared to trade on a basis of 10 cents. Early in January, however, there was something of a flurry among buyers, speculators came in, and the withdrawal of cheap offers in America brought about a sharp rally in London, where from £39 11s. 3d. on January 3 standard moved up to £44 5s. on January 11, wire bars advancing to £49. This improvement was shortlived, and by the end of the month the level of domestic copper in the United States was again 10 cents, while London was listing standard at £39 and wire bars at £44. The January figures showed an increase of some 30,000 tons in world stocks, American consumption being very poor at 25,000 tons, but, even so, 7,000 tons better than December. In America things were decidedly slow, and consumers persisted in limiting their purchases to the lowest possible level consistent with their obligations, so that it is not surprising that the statistical position continued to deteriorate. During February there was a brief rally, standard touching £42 5s. on the 23rd and wire bars £46 10s., but by the end of the following month a sharp fall had occurred, and the year's first quarter ended with standard at £37 18s. 9d. and wire bars at £42 15s.

In spite of the fact that copper business across the Atlantic was so poor, the domestic price remained at 10 cents, perhaps because producers felt it was no use making a reduction, since consumers were so apathetic. At this time, both Russia and Japan were buying pretty freely, and throughout April values in London fluctuated, £40 5s. being reached for standard on the 19th, with wire bars at £45 10s. May, however, came in badly, with standard around £38, and at last, on May 20, the producers in America gave way and dropped their price to 9 cents delivered Valley, standard in London dropping to £35 2s. 6d. and wire bars to £40. A week later, with the newly-established American price being undercut, standard bottomed at £32 12s. 6d., while wire bars touched the lowest level for the year at £37 10s. Then came one of those sudden rallies for which copper is so well known, due probably to the appearance of the delayed April statistics, showing a figure of 130,000 tons for consumption outside the United States. This was undoubtedly a cold douche to the pessimists, for it showed clearly enough that, whatever was happening in the United States, conditions in the rest of the world were such as to absorb a very large tonnage of copper. Somehow or other these rapid changes in copper seem always to come at week-ends, and the 1938 turn-round in values was no exception. The movement developed, and by June 10 standard was £35 and electro 5s. short of £40, while by the end of the month standard was £38 and electro £43. So much for the first half of the year, which, it will be noted, left the price but little more than £1 below that ruling at the beginning.

Second-Half Prices

During the second six months of 1938 copper prices were destined to rule on the whole at a more remunerative level for the producers. On the very first day of July, America went up to 9¼ cents and three days later to 9½ cents, the encouragement given by a strong upward movement on Wall Street providing a stimulus for all commodity prices. By July 6, standard copper in London was at £39 17s. 6d. and wire bars at £45 5s., New York standing at 9¾ cents, while, before the end of the month, two further advances took the domestic quotation to 10 cents and London to £47 for wire bars. Standard was then £41 6s. 3d., and we were beginning to see the development of the wide spread between the two quotations which was to be so much a feature during the autumn months. During August, all markets looked rather tired, for the advance had been very rapid, and consolidation was necessary. In the United States, the price went up to 10¼ cents, but at home the trend was a little reactionary. Actually, the advance in the American price evoked some criticism, for it was felt that the level of usage in the States was not such as to justify a quotation above 10 cents. Throughout the month, however, Japan continued to buy, and this afforded support to the situation. September was completely overshadowed by the dangerous crisis in Europe, which brought this country to

NICKEL AND ITS ALLOYS

(*Continued from page* 45.)

Cast-iron production in Canada and the United States proceeded during 1938 at approximately 50 per cent. of the 1937 level. The decline began late in 1937, carried through the first half of 1938 and reduced some shops to a production level only 20 per cent. of that for 1937. A few of the more fortunate producers were able to operate in the range of 60 to 80 per cent. of the previous year's level. This recession, gaining in velocity at the opening of the year, caught many foundries with large stocks of nickel, with the result that these had to be worked off under reduced operating conditions before the producers again came into the market for nickel. In many cases, six months or more were required to absorb inventory stocks.

Except for the widely-divergent operating rates in the various casting-consuming industries, the diffusion of nickel was maintained, and approximately one-third of the foundries in the United States and Canada produced alloyed cast iron. Nickel consumption was supported by a broadening of the alloyed iron tonnage rather than by an increase in alloy content per ton of castings. Some foundries have raised their production of alloy cast iron to 85 per cent. of their output, and nickel continues to be the most important and most popular of the alloys used in cast iron.

Nickel in Non-Ferrous Foundries

Based on the ten-months' figures, consumption of nickel in non-ferrous foundries should equal that of 1937. This is due to the fact that founders are recognising more and more the beneficial effects of small nickel additions to non-ferrous castings in obtaining higher mechanical properties, greater density, increased toughness and improved wearing properties.

The heat-treated bronzes containing 5 per cent. of nickel came to the front very decidedly during the past year, several foundries producing this composition and other producers planning to do so. High-strength cast and heat-treated nickel bronze is being used for heavy electrical equipment, such as circuit-breaker parts, where a non-magnetic alloy with spring properties and reasonable conductivity is demanded. Considerable interest was also shown in the effect of small amounts of nickel in manganese bronze.

Several producers are now marketing tin-base babbitt metals containing as high as 3 per cent. of nickel. The nickel addition not only increases compressive strength and wear resistance, but also permits the retention of these properties after remelting, a process necessary to the manufacture of bearings. Additions of nickel are also being employed more and more for use with copper-base bearing alloys containing lead.

the very brink of war and presented a parallel to the dark days of August, 1914. In London prices wavered, but there was no panic selling on 'Change, and the general trend was steady, with the quotation in New York moving upwards and achieving 10⅜ cents on September 20.

Considerable attention was being focused just before the European crisis on the world stock position, for in July the total was reduced by about 25,000 tons, followed by a similar reduction in August. The September figures were even more spectacular, with a fall of about 33,000 tons, and October showed the same trend, the reduction this time being about 30,000 tons, bringing the world total of refined down to about 380,000 tons.

Output Restriction Abandoned

With the passing of the crisis, there came an outburst of confidence, and business which had been held up was placed at advancing prices. On 'Change, speculators began to get busy again, and by the end of the first week in October standard was up to £44 6s. 3d. and wire bars to £50 10s., while a few days later £46 3s. 9d. and £52 5s. were reached. The effect of this upswing of values in London on the New York market was very marked, and throughout the first half of October the advance was rapid, until finally, on October 15, 11¼ cents was reached. In the meantime London had been forging ahead, too, £47 10s. for standard and £54 for wire bars being achieved on October 14, on which day the American domestic price reached 11 cents, while three days later the culminating point was reached at £48 7s. 6d. for standard and £54 15s. for wire bars, standard actually closing on that day well below the best, for during the midday session the quotation crossed £49. However, the copper producers had a rod in pickle for the bull operators, and at 12 noon on October 17 the Metal Exchange posted a notice that those producers in the curtailment arrangement had announced a return forthwith to unrestricted production for such period as might be found desirable. As already mentioned, the market closed below the best point reached, and it is certain that values would not have advanced as far as they did but for buying orders given in advance and before the decision to increase output was known. Not unnaturally, the following day brought something of a slump, for bulls were keen to get out at any price, and the net result was a fall to £46 for standard and £52 10s. for wire bars. This collapse, intensified as it was by "stop loss" selling, proved to have been overdone, and the next day brought a recovery of 15s. in both grades; but it soon became apparent that the steam had gone out of the rise, and the market began to exhibit every indication of uneasiness.

On the last day of October, standard was down to £45 12s. 6d., with wire bars at £52 10s., and although some slight improvement occurred during the first half of November, there was evidence of bear selling from time to time and reports from the consuming end of the industry were none too good, domestic sales in the United States for the month, for example, being less than 10,000 tons. On November 22, standard was below £44 and wire bars stood at £50 10s. On the following day, however, the producers sprang another surprise by announcing that output would be cut down to 110 per cent., to come into force on January 1, and on the strength of this standard was bid up to £45, while wire bars advanced to £51 10s. It soon became evident that this announcement in itself was not sufficient to hold copper and, as consumers did not come in to buy, the downward drift began again, with standard bumping on £43 and wire bars at £49 10s. at about the end of November. On December 7, however, it was announced that the date for curtailment at 105 per cent. was to be brought forward to December 15 and that as from January 1 the rate would be 100 per cent. As a result, bears rushed to cover, and standard, which on the previous day had been well below £43, shot up by a full 20s., wire bars advancing also from £48 15s. to £49 15s. Standard closed on December 30 at £44 10s.

TIN

The year opened with the price of tin at £181 10s., but the market, which had crossed over from 1937 in no very cheerful frame of mind, rallied in sympathy with New Year sentiment to reach £191 5s. on January 12. There was an increase in total visible supplies at December 31, bringing these to about 26,000 tons, and as January went on, a downward trend developed, £179 being reached on the 27th and £177 5s. on the following day. Matters jogged along like this through the early part of February until the International Tin Committee took a drastic step and announced a reduction in the quota for the second quarter to 65 per cent., making the rate of output for the world about 140,000 tons. By February 23, tin stood at £190 10s., but, with deliveries in the United States little more than 4,000 tons for the month and buyers holding off, a downward trend developed in March, which took the price down to £167 15s. by the 31st. This weakness in values was hardly surprising, for the position was definitely out of alignment and consumers felt that they had nothing to lose by waiting. April was another poor month and by the end of it £161 15s. had been reached, while on May 3 the price was no better than £153 7s. 6d., for U.S. deliveries were under 4,000 tons and April was thus the worst month since October, 1934. News of a projected buffer pool, however, put some life into the market for a day or two and £160 5s. was achieved on May 4, with £169 5s. on May 12, but from this point a downward trend again developed and on May 27 the quotation was £157 15s. June brought an improvement on news of a cut in the quota to 45 per cent. and a reduction of total visible supplies by 2,500 tons. It was also announced that the buffer pool scheme had been accepted in principle, and June ended with the price at £189 5s.

Formation of the Pool

The second half of the year found tin in much better fettle, and early in July £194 10s. was reached, while the formation of the pool during this month helped to steady what might otherwise have been rather an erratic market. Throughout August and September, in spite of rather indifferent demand and monthly statistics which were not too encouraging, the quotation kept up over £190 and on September 30 touched £197, but it was not until October 6 that the £200 mark was at length crossed, sentiment being more bullish on the all-round improvement in the American business outlook and the better demand there for tin. The aftermath of the crisis also served to release buying of tin which had been held up and, in line with the upward trend elsewhere, the market advanced to £208 on October 10, £211 a week later and finally, in mid-November, £216 15s. was reached. This proved to be the top for the moment and some slight recession took place, although the undertone remained firm.

During the second half of November and early in December, when copper was going downhill, it was noticeable that tin held up well, and although it was recognised that demand was none too good, opinion on the market came to regard tin as being in a sound position and likely to appreciate in value still further. For one thing, visible supplies, which at one time had climbed above 30,000 tons during the year, had registered a useful fall, and, moreover, it was realised that a considerable proportion of this would be held by the pool by the end of the year. In this, of course, there is an element of uncertainty, for with some thousands of tons overhanging the market, even though strongly held, the future is always in some doubt. The closing quotation for standard tin on December 30 was £217.

LEAD

The year just closed was somewhat uneventful for lead and prices fluctuated within fairly narrow limits, with an overall range of about £4. During the autumn the producers formulated a scheme to control output, but there was not much evidence that this was actually functioning. Opening at £15 5s. on January 3, a strong upward movement developed in lead as with the other metals and three days later £16 was reached, while on January 12 a price of £17 13s. 9d. was recorded, this proving to be the highest point of the year. This level, however, proved to be too high, and encouraged a good deal of selling on the market, as a result of which the end of the month found the quotation £2 lower at £15 13s. 9d. The downward movement continued, the price reaching £15 on February 8 and £14 15s. three days later, but a rally occurred later in the month, mainly on professional buying, and £16 3s. 9d. was reached on February 23. March opened at £15 7s. 6d. and £16 18s. 9d. was listed on the 15th, while less than a week later £17 3s. 9d. was recorded, mainly on speculative buying as a result of armament talk. At any rate, the end of the month found the price back to £15 15s. again. Fluctuations followed, but by the end of April the value was £15 and by mid-May £14 10s.; the downward trend persisted through May, for producers seemed to have a lot of metal to get rid of on the market, and consumers were not by any means eager. On May 27 the quotation was £13 8s. 9d. and the bottom was finally reached at £13 5s. on June 9. June, however, proved to be quite a good month for lead, and on the 27th the price touched £15 2s. 6d., a level which was not attained again until early in September.

During July and August the quotation fluctuated between fairly narrow limits, but the trend was rather downwards and on August 12 the price was £14 3s. 9d., while four days later the quotation was down to £14 1s. 3d. However, after this matters improved in quite a marked fashion and on September 8, the price was £15 2s. 6d. Less than a fortnight later, although the crisis was deepening over Europe, the quotation had jumped 21s. 3d. and stood at £16 3s. 9d. on September 19, after which there was a period of fluctuations under £16. Following this came a better trend, with lead at £16 5s. on October 10, while four days later the quotation was £16 18s. 9d., but easier markets again developed, although the price kept over £16. On November 3 the market stood at £15 16s. 3d. and on November 9 at £16 10s., while by November 24 the price had been down to £16 1s. 3d. and up again to £16 8s. 9d. Four days later the quotation was £15 17s. 6d. and the downward trend continued in December, the closing price being £15 8s. 9d.

SPELTER

Last year opened with spelter at £14 11s. 3d., but a brisk advance took the quotation to £15 and a week later to £15 18s. 9d. For the moment, this proved to be the top and was in fact the highest point reached during the year. A fairly rapid decline followed, £14 15s. being reached on January 20 and £14 10s. on the day following, but the trend was still downwards and, after £14 5s. on February 7, the price came to £13 13s. 9d. by the middle of the month. In sympathy with an upward movement in copper, there was a rally after this and on February 23 £15 8s. 9d. was touched, but not held, for early March saw the price back to £13 18s. 9d. There was another recovery to £15 6s. 3d. in mid-March, but by the end of the month the price was back to £13 18s. 9d. again and early in May

(*Continued on page* 52.)

Local reports on—

TRADING CONDITIONS in the CHIEF FOUNDRY CENTRES

To supplement the foregoing reviews of the different sections of the industry, the "Foundry Trade Journal" asked prominent executives in the principal foundry districts of the country to survey the business activity in their own areas over the past year. Their informative comments are given in the following pages.

EAST MIDLANDS

By S. H. RUSSELL (S. Russell & Sons, Limited, Leicester)

THE year which has just ended has been a very difficult and perplexing one nationally, and many of those persons responsible for the foundry industry in the East Midlands area have found conditions to be similar. There are indications that buyers bought castings considerably in excess of their immediate requirements during the year 1937, and that during that period many foundries operated under "boom" conditions. Quite early in 1938 there was a definite falling-off in the demand for castings in almost every section. The concerns which relied principally upon the building trades and the motor trades became very definitely "slack," and several foundries worked a certain amount of short time for long periods during the year.

The outstanding exceptions were, firstly, those foundries (principally non-ferrous) which were producing castings for the various national services, and, secondly, those producing castings for the machine-tool trade. This section of the industry has been greatly stimulated by the rearmament programme, and the demand has been as insistent as it was during 1937. It is an unfortunate fact that without this somewhat artificial and unfortunate stimulus to production, the foundry trade would have had a very lean year, as there is, as yet, no indication of an improvement in the overseas trade.

It is probably not generally realised that the different foundries controlled by the Stanton Ironworks Company, Limited, remelt under normal conditions 9,000 tons of iron week by week, and that the coke consumption for this purpose is in the neighbourhood of 1,000 tons per week. Whilst this enormous output has not been fully maintained during the whole of the year, all the foundries have been well employed, and the "specials" foundry has been working at 100 per cent. capacity, and is likely to do so for some time yet.

Autumn Improvement in Derby

Derby is, of course, the other large foundry centre in the district, but almost without exception the foundries there have not been as busy as in 1937. Since the early autumn there has been a very welcome improvement, and two very large concerns are once more almost up to capacity.

The more localised trades, such as hosiery and shoe machinery construction, have been definitely quiet for long periods, but, as is the experience of Derby, there was some improvement during the last few months, resulting in an increased demand for castings. It has been interesting to note that many foundries have been branching out into the production of both ferrous and non-ferrous castings for the various war services, and have, therefore, had to work to, and to meet, somewhat unfamiliar specifications and tests, with results at times both disappointing and disconcerting; but difficulties have been surmounted, and this district is certainly taking its part in the production of munitions of war.

During the last two years the foundry industry has by stages become accustomed to the strict price control of its raw materials, interlocked with the system of Loyalty Rebates, so much so that the zest for making a good "deal" has died down, owing to the uniformity of prices. Probably this is for the ultimate good of the industry; at any rate, it leaves more time available for concentration on the elimination of waste of these same materials.

Prospects

There is no doubt that many problems and perplexities face the industry in the coming year. The demand for certain types of castings will fall off as the various munition and shadow factories are completed and equipped. The recent firm refusal of an application for a further increase in wages may possibly involve the trade in a labour dispute, but, on the other hand, the price of pig-iron has been reduced, and the re-equipment and reorganisation carried out in many works during the last two years will enable the industry to face the difficulties ahead with confidence.

LONDON

By CHARLES CLEAVER (Kelly & Cleaver, Limited, Walworth)

THE year opened with order-books full, and every promise of a reasonably good future. Costs, however, continued to rise owing to increasing prices of coke and other materials. In spite of this, trade continued briskly for the first three or four months, but then a decline commenced in the amount of fresh business, which continued until after the holiday period. Confidence about this time seemed rather more in evidence, and trade appeared to brighten, but this improvement was quickly cut short at the time of the "crisis," and trade seemed to come practically to a standstill.

In early November there was a distinct upward trend, which again was quickly arrested, probably due to further unrest in Europe. It is generally considered that coke and pig-iron were 10s. and £1 per ton, respectively, too high to encourage and maintain more steady trade. The recent reduction in the price of pig-iron should have a beneficial effect.

Many will find that their sales have decreased by as much as 33 per cent. compared with 1937, but there seems little doubt that, given more settled conditions, London foundries will become busier, and 1938, although not nearly so good as its immediate predecessor, will be found to be fairly well up to the average over the past few years.

LANCASHIRE

By OUR MANCHESTER CORRESPONDENT

IF Lancashire foundrymen had to depend upon cotton textiles for their existence, 1938 would indeed have been a sorry year, for in truth orders for textile machinery were few and far between and certainly quite insufficient to go round. Fortunately, Lancashire ranks amongst the greatest engineering centres in the world, and the manufacture of electrical machinery, gas and oil engines, steelworks and colliery plant, road transport vehicles and locomotives has been maintained at full pressure, with the result that the foundries have in many cases been behindhand with their deliveries. Electrical engineering has been particularly well employed and has been fortunate in being able to secure a number of important contracts in the overseas markets, including Finland, South Africa and Australia, whilst nationally the Central Electricity Board have been good customers. Electrical engineering is indeed important, and one firm alone employs no fewer than 15,000 workpeople.

Foundries serving the road transport and railway industries have been fully occupied. The Vulcan Foundry booked some large orders from New Zealand, India and the Argentine. Though Crewe is not exactly Lancashire, industrially it seems to come within its ambit, and it is interesting to note that this year will see the dilution of the almost purely railway construction industry there, by the creation of two Rolls-Royce engine factories, which are stated to be capable of employing about 7,000 operatives. Leyland Motors have been well employed on a wide variety of output.

The machine-tool industry has been fully em-

ployed right through from January to December and has entered this year with reasonably full order-books. George Richards & Company, of Broadheath, have during the year made two boring mills capable of taking work up to 22 ft. diameter, each weighing about 190 tons. The general engineering works in the district have some exceptionally interesting jobs to their credit, in such diverse lines as flour milling, grain elevators, mining equipment and coke-oven plant.

For the textile industry, the future is of exceptional interest because of the trade agreements recently concluded with Egypt and the U.S.A. If the American trade agreement does half as much good as the previous raising of trans-Atlantic barriers did harm, then indeed Lancashire will be well satisfied.

Despite the low level of trading conditions in everything to do with textiles, the district taken as a whole has been reasonably well occupied. No fewer than 90 new factories have been secured for the county during the year, and the shipbuilding and repairing activities at Barrow and Birkenhead have been really busy. Not only for British naval requirements has Barrow been working, but also it has been turning out warships for the South American Republics, whilst Birkenhead repaired a matter of three hundred ships, representing about 1,400,000 tons gross.

The local Branch of the Institute of British Foundrymen has enjoyed a very successful session under the presidency of Mr. R. A. Jones and latterly of Mr. H. V. Grundy. Mr. Jones during his term of office directed attention to (1) the attraction of fresh lecturers by the organisation of a Coronation Technical Paper Competition, carrying monetary prizes, and (2) the stimulation of a higher level of technical discussion by the creation of a fund from which awards will be made from time to time. During the year, the Manchester Association of Engineers issued a report of a successful symposium on Impact Testing on behalf of most of the major national technical institutes, and much of the credit must go to its secretary, Mr. T. Makemson.

Political upheavals apart, Lancashire is in general quite optimistic for 1939.

SCOTLAND

By JOHN BELL (Albert Smith & Company, Glasgow)

FOR nearly all sections of the foundry trade in Scotland, 1938 was a somewhat disappointing year. The year 1937 had been one of rising prices and expanding business, and with the shortsightedness typical of men in all ages, many founders acted as though the conditions of 1937 would continue indefinitely. Many of them were purchasing supplies much in advance of their normal requirements, and were thus rendering more probable the very increases they were trying to avoid.

In the autumn of 1937 there were signs that the rising curve of orders had passed its maximum, and that it would soon be showing a very decided fall, and in this condition 1938 arrived.

Most foundries had accumulated fairly heavy stocks of pig-iron, scrap, coke and other supplies, and the sellers of these commodities soon found that there was no longer any need to divide up the available supplies in order to give each of their customers a share. Indeed, a position was soon reached when those who had been feverishly ordering additional supplies became much more concerned about holding back, than about receiving, the goods they had ordered.

This condition continued, more or less, all through the first half of 1938. Order-books, which were fairly well filled in January, began to show signs of distress, as existing orders were being executed at a faster rate than new orders were being booked, and a comparison between the order-books on January 1 and on December 31, 1938, would leave no doubt as to the general trend during the year.

Light Castings

The earliest signs of the scarcity of new business were first noted in connection with the light castings industry, located chiefly in Falkirk and district, although the light castings foundries in Glasgow and elsewhere all shared in this general movement. The recession of orders, while not quite uniform in all sections of the light castings trade, has, nevertheless, been sufficiently so to make 1938 one of the worst years it has experienced for a long time.

The tale is, indeed, a doleful one, and there are few bright spots to relieve it. The reduction in the housing programme affected all sections of light castings, and, quite early in the year, foundries began to see stocks of all kinds growing as the rate of production raced ahead of the booking of new orders. Baths, cisterns, rain-water pipes, gutters, soil pipes and fitted goods all began to tell the same story, and by the springtime most firms had reduced their manufacturing programme to keep their stocks within reasonable limits. Yet stocks were still growing, and the middle of the year saw a further drastic cut in output. In the case of many firms work was confined to three days a week, and that with a reduced number of workmen. This helped considerably to balance things, but the last two months of the year have witnessed an almost complete stoppage in the industry.

To some extent this was to be expected. Merchants, like founders, had been buying ahead during the period of rising prices, and the slowing down of demand had left them, also, with stocks which were uncomfortably large. These had to be liquidated, and during the process of liquidation purchases were reduced to a minimum. That condition has existed during the greater part of the year, and, with the approach of November, the feeling gained ground that the beginning of 1939 would see a reduction in the price of pig-iron, with a consequent reduction in the price of all articles into which pig-iron entered.

Thus the merchants sat tight, with the result that the last two months of the year were about the worst the light castings trade has experienced for many years. In some cases foundries have been completely stopped for a week or two, to bring stocks down to the low level demanded by the conditions.

Now that a reduction of pig-iron prices has been intimated, taking effect as from the beginning of the year, it is hoped that the reduced prices of light castings which will likely follow, coupled with the anticipated scheme for a new expansion of house building, will bring in a period of better trade for all in this side of the foundry industry.

Conditions, so far as the works people are concerned, would have been worse in some districts had not the firms, in order to keep their men employed, proceeded with certain orders, delivery of which will not be required till well on in 1939. Such firms might have saved some money by holding back this work till the New Year, but perhaps they feel satisfied that, in keeping their men employed during the period under review, they acted in the best interests of all.

One other bright spot, considered from a local point of view only, is that the scarcity of orders, coupled with the stabilisation of prices, have prompted certain buyers to send their orders to firms whose prices are not always lowest, but whose products have built up a world-wide reputation for quality and excellence.

Engineers' Castings

In the engineering side of the industry, conditions have been more variable. While in some sections the tendency has been like that in the light castings trade, it has, on the other hand, been very satisfactory in others.

Scotland, of course, depends largely on shipbuilding, and the serious decline in new tonnage placed during the year had its effect on those foundries which specialise in castings for marine work. Here, again, the first half of the year was reasonably good, but since midsummer there has been a gradual reduction in output, and the prospects for the immediate future are not too bright. This is particularly so in the case of foundries making the larger castings, as, apart from naval work, there are few large vessels on hand.

The naval programme has helped, to some extent, to fill up the gap caused by the scarcity of orders for general cargo and passenger vessels, but, as the supply of castings for naval ships is drawn from a limited number of foundries, a fair amount of merchant shipping is always required to keep the other foundries going.

The position is not so bad in those foundries making castings for marine auxiliaries as in the foundries making castings for the main propelling and steering machinery, deck castings, propellers, and the like. Indeed, in some cases, foundries specialising in castings for marine auxiliaries are working at normal output, and any tendency to a reduction is due, not so much to a scarcity of orders as to the fact that the machine shops can hardly take delivery of any more castings meantime.

The "Queen Elizabeth"

During the year publicity was focused on the "Queen Elizabeth," due to the launch of that vessel in September, but the big ship did not provide very much work for the heavy foundries during the year. The castings for the propelling machinery were all completed before 1938 came in, and, while there is still much work to be done, and many castings still to be supplied, these form a very small part of the total on a ship of such magnitude. Incidentally, it may be of interest to note that one light casting foundry, at any rate, found it exceedingly useful to have work for the "Queen Elizabeth" on its books. It kept many of the men employed when orders from the more usual quarters began to fall off.

It is hoped that the reduction in the price of steel plates and sections will lead to the placing of orders for new tonnage in 1939, for this would be a considerable help to more than one section of the foundry trade.

Ingot Moulds

Amongst the foundries which experienced a considerable falling-off in output during 1938 must be included those making ingot moulds, slag tubs, and general steelworks' castings. Like the heavy marine founders, this group is dependent largely on shipbuilding, although steel-structural work generally helps them.

In this group, as might be expected, the conditions were similar to those in the marine castings group. Business remained very good till July, when it began to taper off badly, growing worse as the year advanced. Naturally, the intimation of the reduced price of steel as from January 1 this year delayed purchases during the closing weeks of 1938, but this will probably result in an increase of orders in the early weeks of the New Year, and if this is so, then the ingot mould makers, like their close friends the steelmakers, will see an improvement very soon. There has been, of course, practically no change during the year in the output of moulds for the making of armour plate.

It is worth recording, also, as an evidence of the faith which guides the men who lead in this section of industry, that the largest ingot mould foundry in Scotland is busily engaged extending its works, obviously in the hope—possibly the expectation—of having still more work to do in the near future than it has ever done before. Let us hope this reading of the signs is true.

Machine Tools

One of the bright spots has been the machine-tool trade. Founders engaged in this class of work have had a good year—possibly too good a year, as some others, not normally in the machine-tool trade, may now think. There has been practically no change in the output of the machine-tool founders during the year, and if at times a slowing down has been noted, this has been due, as in marine auxiliaries, to the foundries running ahead of the machine shops. One other cause has been, perhaps, the delay in getting new designs through the drawing office and patternshops, but, when these do come through, it would appear that the machine-tool people will be able to look forward to a New Year which will be for them as busy as the one which has just ended. And that possibly has been the best for many years.

The difficulty in getting machine-tool castings prompted many firms, with no experience of this work, to take some of it on hand. The results have not been quite so successful as many of them had expected, and if they have added to their experience, they have probably, in a like ratio, added to their sorrows.

Sugar Machinery, Railway and Boiler Castings

Other sections of the trade are in the doldrums, and like most of those already referred to, they have had a disappointing year. In the sugar machinery group only the first three months were really good, with here and there during the remainder of the year a bright patch, which only served to throw into greater relief the quietness in which they lived. Towards the end of the year a demand for rolls and other spares helped considerably, but the general condition over the year has not been satisfactory.

Railway work was rather better, and the reduction in mineral and ordinary goods traffic was balanced somewhat during the summer by an increase in passenger traffic. September brought an end to the usual summer services, with the result that foundries making railway castings found orders slowing down in the month of August. It is hoped that the "square deal" will have corners sufficiently rounded to enable the wheels again to get going.

Boiler castings generally have been in demand, especially in the case of firms making a speciality of certain types of boilers. The weekly output was possibly a little less at the end of the year than at the beginning, but in the latter case overtime helped to swell the output, and possibly, also, the costs. At any rate, in this section, 1938 has probably been a very satisfactory year.

Another of the good spots has been hydraulic castings, where the high average tonnage of 1937 has been very well maintained. Variations have occurred now and then during the year, sometimes the heavy castings forming the major portion of the output, while on other occasions the lighter castings held premier place. During the last few weeks of the year inquiries were rather more plentiful, and while there are no big schemes on hand at present, the day-to-day orders have been very satisfactory.

Other sections of the trade have reflected the general conditions prevailing in the country, and possibly the small jobbing foundries have suffered most in the general decline. Not only have they found a reduction in the volume of available business, but they have also had to meet competitors coming into their market from other sections of the trade.

Steel and Non-Ferrous

Steel and non-ferrous castings have moved on the same general lines as grey iron castings. The decline in shipbuilding has affected the heavy steel-castings output, except in the case of those who are engaged on Admiralty work, and, even in this section, orders are being rapidly completed. Medium and light castings have also quietened down considerably during the year, and here again founders are waiting anxiously to see what increase in business is likely to follow the reduction in prices recently announced.

Steel castings for colliery work are naturally quiet, since the coal trade itself has had a quiet time, and one steelfounder, at any rate, was thankful for the results of the international crisis in the autumn, since A.R.P. created a great demand for wheelbarrows, and that in turn sent up his orders for barrow wheels with a bound.

At the moment, all over the foundry trade in Scotland there is a quiet expectancy. Iron and steel prices are reduced. There is a talk of an extension of house building, and of further additions to the Admiralty programme. Recently, inquiries have been moving more freely than for some time, and there are prospects of some additional ships being ordered from the Clyde yards. Scotland is hoping these things will all unite to make 1939 a happy and a prosperous year.

SHEFFIELD

By J. ROXBURGH (Davy & United Engineering Company, Limited)

A SPIRIT of optimism in regard to trade seemed to be prevalent at the commencement of 1938, and, although no one expected the boom conditions of 1937 to be continued, most people were of the opinion that, without the occurrence of any major disturbances, at least normal trading would be experienced. This belief was backed up by the fact that many orders were left uncompleted at the end of 1937 and many schemes and programmes were still envisaged. However, and probably contrary to general expectation, before six months of 1938 had elapsed a definite recession in trade had become evident. Many reasons have been advanced for this turn of affairs, including overbuying and over-stocking during 1937, and also the great trade depression which was being witnessed in America.

Later, in September, the international crisis caused a lull in demand, and then everyone seemed to sit tight, anxiously awaiting the announcement of the new prices for steel, pig-iron and coke, which prices were made public in early December. Although costs still remain high, these prices showed a welcome reduction, and apparently this gave a stimulus to trade during the last month of the year. Some of the leading authorities on trade matters, although to the layman there seems to be no apparent justification for the opinion, go so far as to say that 1939 will prove to be more prosperous than 1938, and, at any rate, will not be any worse. It is evident from the foregoing that, despite a good beginning, 1938 has been a difficult trading year, with its fluctuations of trade and finally a recession; but it would appear now that signs of improvement are manifesting themselves and that a quiet and restrained spirit of optimism in trade and commerce is awakening.

Normal Capacity Working

It will now be readily acknowledged that the volume of trade during 1937 was exceptional, and that the majority of firms had been working above normal capacity. During 1938, possibly the firms, except those dependent entirely on rearmament work, would concur that they have worked to normal capacity, have been able to effect more normal deliveries and have not been unduly hampered by scarcity of supplies of raw materials or protracted deliveries of plant, such as was the case in 1937. If, as a possible criterion, one consulted statistics of the steel output of the country, it would be found that its effective capacity to-day is 14½ million tons. The output of steel ingots and castings for 1938 will probably be of the order of 10½ millions, the highest annual output except for those of 1936 and 1937, the latter's figure being 13 millions.

Recent Laboratory Extensions

It can be taken for granted that Sheffield's principal industries are well known, when it is realised that the quality of Sheffield steel has an international reputation and that to-day also the uses of stainless steel, discovered 25 years ago in Sheffield, are manifold. It is only to be expected that, technically, Sheffield occupies virtually the leading position in the world, and its experts enjoy world-wide fame. The research laboratories of the city are constantly employed on development work, and their value to industry is displayed in the practical application of their results in the works. During 1938, it is interesting to report that new laboratories, kindly given by Sir Robert Hadfield, were opened at the Applied Science Department of the University, and that in December new laboratories were officially opened by Sir Wm. Bragg for the Admiralty, in Sheffield.

Still Larger Castings

Sheffield has many engineering firms in the district which devote themselves to the manufacture of steelworks plant, such as rolling mills, presses, blast furnaces, coke-oven plant, etc., and all the various incidental castings, whilst other firms are interested in their own particular lines. Many of these engineering firms have their own foundries, whilst there are other totally detached foundries. Generally speaking, one would say that Sheffield has earned the reputation of producing some of the largest and heaviest castings, be they iron or steel, in this country, and in achieving this have gradually built up some of the largest foundries.

The largest steel foundries of the country are located in Sheffield, and they generally combine a mixture of jobbing and repetition work, and a great deal of new plant has been introduced during 1938 to deal with this varied output. For instance, one foundry has laid down a large sand drying and reclaiming equipment with beneficial results. During the year, too, one steel foundry in particular has undertaken the manufacture of abnormally heavy castings, heavier than ever before attempted by them, some of the castings being 120 tons in weight when finished.

These heavy steel castings were supplied to an engineering concern in the district, who are manufacturing, for Russia, the two largest presses that have ever been made in England, one a 15,000-ton bending press and the other a 12,000-ton forging press. In turn, this company's iron foundry has been called upon to manufacture large castings for this plant. This particular company has also completed during 1938 continuous hot strip and cold mills for Ebbw Vale, to American design, which is the first plant of its kind ever to be erected in England and capable of an annual output of over 600,000 tons. This plant has made demands on the iron and steel foundries, and many of the iron castings contained alloys—nickel, chromium and molybdenum—and in some cases were heat-treated to give Brinell figures of 450 to

500. Rolling mills for India and Turkey, too, are under construction.

Another iron foundry, attached to an engineering company, has undertaken the manufacture of exceptionally heavy castings during 1938, principally ingot moulds and anvil blocks up to 150 tons, and one wonders, as these weights become larger each year, what will be the limit eventually in regard to weight. This company has also supplied rolling mills, rolls and alloy rolls, both at home and for export to India, South Africa and Turkey.

A number of the iron foundries in Sheffield to-day cater for high-duty and special iron castings, and reports from the various companies indicate that excellent progress is being made in these directions. One company reports that they are successfully manufacturing air-heaters and economisers, of special design and of special metal.

Unemployment Rising

Generally speaking, the foundries in Sheffield and district have been fortunate in that they have been steadily employed during 1938, although during the latter part of the year orders definitely dwindled, and, recently, the foundries have not been running to normal capacity and, in some cases, men have had to be laid off or short time is being worked. Outputs generally are lower than 1937, but are still probably normal over the year for the individual foundries. Regarding unemployment in Sheffield for all trades, there are 8,000 more out of work at the present time than twelve months ago.

Co-operative Endeavour

The Sheffield Trades Technical Societies, which are unique in this country, now boast over 3,000 members, and cater for sixteen different sections of industry, including a foundry section. Its activities have increased enormously and the lectures have been better attended. The classes in foundry practice and science, in connection with which examinations are held for the City and Guilds Certificate, have been attended this year by practically double the number of students hitherto, and great keenness is being displayed.

The Sheffield Branch of the Institute of British Foundrymen has had another very successful session under the able guidance of Mr. J. B. Allan, and this session Prof. J. H. Andrew, of the University, is President. During 1938, as reported in a recent issue of the JOURNAL, the Branch held an Apprentice Patternmakers' Competition, and it is gratifying to record that there were 37 entries in all. It was indeed a very successful effort by the Branch and evoked a great deal of interest locally.

The Future

Undoubtedly, in Sheffield and district, both the practical and technical aspects of the foundry industry are receiving the attention they merit, and progress is being recorded. A great deal of research work is continually being carried out at the works, the University, or under the auspices of some society or institute, and this augurs well for the maintenance of the high quality of the products for which Sheffield is worthily famous. Provided there are no serious setbacks, whatever form they might take, Sheffield can look forward to the future with confidence, feeling that whatever the gods have in store for her as regards trade in 1939, she will, by virtue of keeping abreast of times, receive her fair share of orders.

SOUTH WALES

By W. E. CLEMENT (President, Welsh Engineers' and Founders' Association)

THE year 1938 has been most disappointing for the foundry trade in South Wales generally, and in South-West Wales in particular. The foundry trade in the western area is far too dependent on the steel and tinplate trade, and as that particular industry has been exceptionally depressed for the last nine months or so, it will be appreciated that the foundries, other than those owned by one or two large groups, have had a very lean time. With the exception of a firm at Landore, none of the foundries appears to have had any share in armament work, and as a result the amount of short time worked has been considerable. In fact, it would be correct to say that the men have been idle one week out of every three. For the first three months of the year there was some work to finish up for the Ebbw Vale steelworks contracts, but after this was delivered no new work came along, and business has been going from bad to worse.

In the eastern area, which is not so dependent on steel and tinplates, the position has not been quite so bad, and one or two works, notably one at Pontypridd, have a fair amount of Government work.

With the exception of the Ebbw Vale plant and the new Guest, Keen & Nettlefolds plant in Cardiff, there have been no developments, and foundries have had to be content with maintenance work chiefly.

The foregoing notes refer to iron and steel foundries in particular, and do not apply to engineering and fabricated steelwork. To give the writer's own case as an instance, there are three departments (foundry, machine shop and steel fabrication and welding work), and the first has been really bad, the second poor, and the third can almost be described as good.

The prospects for 1939 do not at the moment appear to be good, and it is a personal opinion that the present situation will not improve until the demand for tinplates and galvanised sheets shows a marked increase. That can only come about with more stability in the international situation.

TYNESIDE

By COLIN GRESTY (North Eastern Marine Engineering Company (1938), Limited, Wallsend)

IN considering the foundry activities on Tyneside during 1938 and the prospects for 1939, it is necessary to draw a line between those foundries which depend primarily on shipbuilding and marine engineering and those which cater for other industries.

The second group includes those foundries manufacturing castings for heavy machine tools, turbines and other plant for power stations, colliery plant, railway equipment, rolls for steelworks, and many other classes of castings for general engineering purposes. On the whole, these foundries have been exceptionally busy during the past year—some, in fact, have achieved record outputs—and have very good prospects for 1939. Whilst it is hardly anticipated that the high 1938 level of production will be altogether maintained, sufficient work is on hand and in prospect to ensure satisfactory working and to justify the optimistic outlook which prevails.

Shipbuilding and Marine Engineering

So far as the foundries connected with shipbuilding and marine engineering are concerned, the past year has proved a rather disappointing one. During the first few months work was plentiful but, unfortunately, that state of affairs did not continue and there was a gradual falling-off in production. Towards the end of the year many of the foundries became definitely slack and the immediate outlook is somewhat uncertain. This decline in activity was due chiefly to the serious drop in freights which occurred, together with the increased costs of material and labour, the result being a considerable reduction in orders for new vessels.

There has been, and still is, a large volume of naval work in progress on the river, which has provided some foundries with a fair amount of work but, taking the district as a whole, this has not been sufficient to offset the decline in mercantile shipbuilding. Fortunately, however, the vital importance to the country of the mercantile marine, both for purposes of normal trade and also for times of emergency, appears to be realised more to-day than ever before. It is confidently expected, therefore, that some form of Government assistance for the British shipping industry will be the outcome of negotiations at present taking place. It is hoped also that the recent reductions in prices of steel, pig-iron and certain other materials will encourage the placing of further orders. Whilst the immediate outlook, therefore, is not particularly bright, there is a feeling of optimism that means will be found very shortly to ensure a steady flow of new construction.

New Foundries Opened

In another respect, the past year has been a specially notable one in so far as two new foundries have been opened and a third one is almost ready to commence production. This is a very welcome sign in a district which has suffered severely from industrial depression for a long period.

The largest and most important of these new foundries is that of Jarrow Metal Industries, Limited, which company is associated with the Jarrow Tube Works, Limited, and Sir W. G. Armstrong, Whitworth & Company (Iron-founders), Limited, of Gateshead. For many years there had been a shortage of steel foundries on Tyneside—felt very acutely during the busy time in 1937—and the new foundry was erected to relieve this position and at the same time to provide billets for the Tube Works and also to facilitate the extension of Armstrong, Whitworth's roll-founding business.

The melting equipment of the new foundry includes a 15-ton electric arc furnace with hydraulic regulator and a 30-ton air furnace, fired by pulverised coal. The electric furnace is capable of five casts per day and is used for the production of special alloy rolls, for carbon and alloy steel castings up to 10 tons in weight, in addition to billets for the Tube Works. The air furnace was installed for the manufacture of rolls and, in conjunction with the electric furnace, rolls up to 40 tons in weight are produced and the range of compositions available is very extensive. Annealing and heat-treatment are carried out in large gas-fired furnaces under pyrometric control, and the foundry is complete with sand-preparation plant, drying stoves and shot-blasting equipment. For the necessary metallurgical control of materials, melting and heat-treatment, and for experimental purposes, there are fully-equipped chemical and testing laboratories.

The second foundry is that recently erected by Chas. Crofton & Company (Engineers),

Limited, Wallsend, for the production of special gunmetal and other non-ferrous castings. The output is only small at present—about 100 tons per annum—but arrangements have been made so that this can be rapidly augmented if necessary.

The third foundry is at present under construction at the works of the Parsons Marine Steam Turbine Company, Limited, Wallsend-on-Tyne. It consists of two bays, each 150 ft. long by 41 ft. wide, and is being provided with equipment for the manufacture of iron castings up to about 4 tons in weight and non-ferrous castings up to 2 tons. For the cast-iron work two cupolas are being installed, whilst the melting equipment for the non-ferrous metals will consist of two oil-fired tilting furnaces and a battery of pit furnaces, most of which will also be oil-fired. The capacity of the foundry will be approximately 300 tons of iron castings and 350 tons of non-ferrous castings per annum.

Further evidence of the improved conditions of the foundry trade in the district during the past two years or so compared with the preceding period lies in the greater support given to the Newcastle Branch of the Institute of British Foundrymen. The membership has increased considerably, attendance at the meetings has greatly improved, and altogether a more lively interest has been taken in the activities of the Institute.

WEST MIDLANDS

By OUR BIRMINGHAM CORRESPONDENT

VARIABLE conditions prevailed in the foundry trades in the West Midlands area during 1938. While in the light castings section the volume of trade did not prove as heavy as many of the leading firms anticipated when the year opened, the demand from the engineering and allied trades continued at a steady pace with the exception of a brief set-back due to the international crisis. Since Munich, however, business has been steadily returning to normal. Armaments, of course, have had a great deal to do with the maintenance of output at the Midland foundries, and with a general speeding-up of production in this direction, now in full swing, the outlook for Midland iron and steel foundries is highly promising. In no section, however, are boom conditions expected to prevail during 1939.

Apart from the requirements of the various national defence schemes, electrical and mechanical engineers were fairly steadily employed throughout the year, but, as in the machine-tool trade, many firms at the end of the year found that the carry-over was somewhat lower than was the case at the end of 1937. Heavy ironfounders in the Midlands have little cause to complain of the conditions prevailing during the greater part of the past year.

Motor Trade

To a great extent the demand for malleable iron follows upon the prosperity or otherwise of the motor trade. The uncertainty of the international situation was mainly responsible for several of the leading motor-car firms experiencing a somewhat lean time during 1938, but during the last quarter of the year an upward trend came into evidence. At the moment there are distinct signs of an all-round improvement and leaders of the industry prophesy that more normal conditions will prevail during the coming buying season. At any rate, production of the new models is now in full swing at all the local motor-car establishments.

Light ironfounders naturally suffered from the decline in the building trades, particularly the recession which occurred in house building by private enterprise. In some quarters the belief is held that the lessened activity experienced last year in this direction was due to the increase in the cost of building materials generally. However, there are many housing estates in the hands of private builders who are anxious to complete their development, and all that is required to enable them to do so is a reduction in the cost of materials. On the other side of the picture, the various municipalities have been compelled to carry on with their slum-clearance and over-crowding schemes. In order to meet the ordinary housing needs the leading local authorities are now engaged upon five-year programmes in response to a request from the Ministry of Health. While at the moment light ironfounders have not much hopes of a revival of house building by private enterprise, they anticipate that municipal activity will not only bring about a marked improvement in the near future but that it will result in a much greater demand during the next year or so. Although during 1938 they may have experienced a somewhat lean time, the prospects are undoubtedly brighter than they were six months ago.

The slackening of activity in housing, of course, also adversely affected the demand for firegrates, stoves, cast-iron hollow-ware, etc., so far as the home market was concerned. Here, again, a slight improvement was reported towards the close of the year. Optimism prevails in this section of the foundry trade as it does among steel founders, who were able to maintain a steady output throughout 1938.

The tendency towards the mechanisation of foundries in the Midlands continued throughout last year, and several firms who have carried out extensions have taken advantage, if only partially, of mechanisation. Several of the leading firms realise the value of a continuous-casting plant and other mechanical devices, and inquiries indicate that, given favourable conditions, they intend during the coming year to modernise their foundries.

WEST RIDING OF YORKSHIRE

By A. S. WORCESTER (Kaye & Company (Huddersfield), Limited)

TRADING conditions for the jobbing iron foundry during 1938 have been of a very mixed character. The year opened on a very brisk note, but business gradually fell off in volume, and by September it became very quiet. The decline in business began to evince itself also in a demand for lower prices, and as competition became keen many founders were forced to reduce prices without obtaining any compensation in the price of raw materials.

Generally speaking, engineering firms in this area possessing their own foundries have been better placed. Machine-tool makers in particular have had an excellent year, and while some slackening-off is noticeable, the prospects for 1939 appear to be bright. Valve makers have also had a very busy year, but indications are that business will be upon a much-reduced scale during 1939, although individual firms have some fairly substantial contracts still in hand. General engineering has had a rather uneventful twelve months, trade being on a reduced scale as compared with 1937. Conditions for 1939 are rather obscure, but it is felt in this area that better use could have been made of the heavy engineering concerns for work in connection with the rearmament scheme. Printing machinery makers have also had a quite satisfactory trading year in 1938, and many have substantial orders on the books for 1939.

Wool textiles have been a particularly black spot during 1938, unemployment having increased and trading conditions becoming stagnant. The subsequent effect on textile engineers was short-time working and unfavourable balance sheets. Export trade of textile machinery is almost non-existent and accounts for a good deal of the prevailing despondency about the prospects for 1939.

The trade barometer for 1939 in this area appears to be moderate to fair, but for some sections there are uncertain conditions in the offing.

The technical side of the industry is steadily getting better. The national conference of the Institute of British Foundrymen during the summer was a success, particularly as it was the area's first attempt. The training of apprentices in this area seems up to the standard, and every facility is given by the technical schools. The young men in the industry are now making their presence felt, with their better training and new ideas.

NON-FERROUS METAL MARKETS

(*Continued from page* 46.)

£12 8s. 9d. was reached. Demand was now decidedly poor and stocks were increasing, and although May 5 saw the price up to £13 5s. it was no better than £12 on June 1. Three weeks later saw the value up to £13 2s. 6d. again, while, following a turn round in general sentiment, £14 1s. 3d. was reached on June 23. Following this came a period of fluctuating prices, with the quotation above and below £14, but on August 18 the price was again under £13, with a recovery, however, by the month-end. On September 12, £14 was again reached and £14 17s. 6d. a week later. Early October saw £15 2s. 6d., but thereafter there was a falling away to £15 at the end of the month and still lower prices during November and December.

Off and on during last year there was a good deal of talk about the chances of the Zinc Cartel being revived, but actually, with Germany virtually a "non-starter," the chances of this coming to pass are rather remote. Of more interest probably was the question of an increase in the rate of import duty, which was under discussion during the last quarter without any decision being announced. The proposals provide for an increase to 30s. per ton with a system of drawbacks for export business, and the general impression has been that in spite of obvious disadvantages in an increase in taxation on raw materials the scheme would go through.

Steel Industry and the Railways

The railway companies have had two meetings since the Christmas holiday with representatives of the iron and steel industry in connection with their "square deal" proposals. The discussions have been exploratory in the main. The railways have sought to learn what the attitude of the steel industry might be towards their proposals, but, as the measure of freedom which the railways may ultimately enjoy is still in doubt, no very definite indication could be forthcoming. It is learned, however, that the railways have agreed in principle to the granting of safeguards to the steel industry in the matter of rates, and have also agreed in principle to a long-term stabilisation of rates and conditions for rail transport of iron and steel and raw materials.

Tentative Programme for—

INTERNATIONAL CONGRESS in LONDON

JUNE 12 to 17

PLANNED by the Institute of British Foundrymen under the auspices of the International Committee of Foundry Technical Associations, the next International Foundry Congress will be held in London from June 12 to 17, and will be followed by a tour of the principal foundry centres of Great Britain from June 18 to 24 and from June 25 to 30. The President of the Congress will be Mr. W. B. Lake, J.P., President of the Institute of British Foundrymen for 1939-40. A number of prominent industrialists and scientists have consented to give their patronage to the Congress, the secretary of which will be Mr. T. Makemson, secretary of the Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, 3.

It is expected that about five hundred delegates will attend the Congress from the majority of European countries, the United States of America, and from many parts of the British Empire. The programme for the Congress caters for the presentation of more than twenty Papers, to be presented by authors representing the Institute of British Foundrymen, and the equivalent foundry technical associations in other countries. A feature of great interest will be the presentation of the annual Edward Williams Lecture by Professor W. L. Bragg, O.B.E., M.A., D.Sc., P.R.S., one of the world's foremost physicists. The managements of a number of works have consented to their plants being opened for inspection by the delegates, who will also be able to visit the National Physical Laboratory. A delightful programme of evening functions has been arranged, whilst ladies will be able to see places and industrial establishments of interest to them.

The Post-Congress Tour is divided into two sections, as shown below, so that delegates whose time in England is limited may leave on June 24 if they wish. The tour is largely occupied by works visits, but opportunities are also given to see the scenic beauty of Great Britain, and in the evenings delegates will often be the guests of the various Branches of the Institute of British Foundrymen.

The cost of attending the Congress is moderate, and all those who are interested in the Congress and/or the Post-Congress Tour, are asked to communicate either with the nearest office of Thos. Cook & Son, Limited (Cook/Wagon-Lits-World Travel Service), who have been appointed official travel agents for the Congress, the secretary of the foundry technical association of which they are members, or the secretary of the Institute of British Foundrymen at the address given above.

PATRONS OF THE CONGRESS

The Rt. Hon. OLIVER STANLEY, M.C., M.P., President of the Board of Trade.
The Rt. Hon. the EARL of DUDLEY, M.C., T.D.
The Rt. Hon. the VISCOUNT GREENWOOD of HOLBOURNE, P.C.
The Rt. Hon. the VISCOUNT WEIR of EASTWOOD, P.C., G.C.B.
The Rt. Hon. LORD ABERCONWAY, C.B.E.
The Rt. Hon. LORD AUSTIN of LONGBRIDGE, K.B.E., LL.D.
The Rt. Hon. LORD HIRST of WITTON.
The Rt. Hon. LORD McGOWAN, K.B.E.
The Rt. Hon. LORD RIVERDALE, K.B.E.
The Rt. Hon. LORD STAMP of SHORTLANDS, G.C.B., G.B.E.
Lt.-Col. Sir JAMES LITHGOW, Bt., M.C., T.D.
SIR WILLIAM BRAGG, O.M., K.B.E., P.R.S.
Professor SIR HAROLD CARPENTER, M.A., Ph.D., F.R.S., A.R.S.M.
SIR ANDREW DUNCAN.
SIR NIGEL GRESLEY, C.B.E., D.Sc.
Brig.-Gen. SIR HAROLD HARTLEY, C.B.E., M.C., P.R.S.
SIR WILLIAM LARKE, K.B.E.
SIR FELIX POLE.
Lt.-Col. J. H. M. GREENLY, C.B.E., M.A., M.I.E.I.
H. MOORE, Esq., C.B.E., D.Sc.
Professor W. L. BRAGG, O.B.E., M.A., D.Sc., P.R.S.
H. J. GOUGH, Esq., M.B.E., D.Sc., Ph.D., F.R.S.
C. H. DESCH, Esq., D.Sc., Ph.D., F.R.S.
E. J. FOX, Esq., M.I.Mech.E.
J. G. PEARCE, Esq., M.Sc., M.I.Mech.E., F.Inst.P.

TENTATIVE PROGRAMME

On Sunday, June 11, there is to be informal hospitality and sightseeing under the guidance of members of the Institute of British Foundrymen and their ladies, and a garden party at the home of Mr. Barrington Hooper, C.B.E., and Mrs. Hooper.

On the Monday, the Registration Office and the Information Bureau will be open at the Dorchester Hotel, Park Lane, W.1 all day, and in the afternoon there will be Committee, Council and business meetings of the Institute of British Foundrymen. Informal arrangements for sightseeing are being made for the evening.

Tuesday morning is to be devoted to the official opening of the Congress, after which the Fourth Edward Williams Lecture by Prof. W. L. Bragg, O.B.E., M.A., D.Sc., P.R.S. (Director of the Cavendish Laboratory in the University of Cambridge), will be delivered. During the afternoon there is to be a technical session followed by a reception in the evening.

On Wednesday morning, June 14, there is to be a Non-Ferrous Technical Session and visits to some local foundries. Ferrous subjects are to be discussed in the afternoon, and in the evening there is to be a banquet at the Dorchester Hotel.

The next day is to be one of technical sessions and local works visits, with a reception in the evening, whilst Friday is to be devoted to visits to foundries.

On Saturday, June 17, there is to be an excursion to Windsor and on the River Thames, after which the Congress closes.

A special programme consisting of social gatherings and visits to places of interest is being arranged for ladies.

Works Visits

It is expected that delegates will be able to make their selection of works visits from the following firms, all of which are either in London or the area. Arrangements for additional visits are also in hand:—

The Sterling Manufacturing Company, Limited; J. & E. Hall, Limited; R. & A. Main, Limited; Belling & Company, Limited; Manganese Bronze & Brass Company, Limited; Gillett & Johnston, Limited; Fry's Diecastings, Limited; Bagshawe & Company, Limited, Dunstable, Bedfordshire; Ford Motor Company, Dagenham; Ealing Park Foundry, Limited; the National Physical Laboratory; Crane, Limited, Ipswich, and E. R. & F. Turner, Limited, Ipswich.

Post-Congress Tour

The Post-Congress Tour for overseas visitors and ladies will commence on Sunday, June 18. Section "A" of the tour will terminate in Manchester on Saturday, June 24. At all the places visited, special arrangements will be made for the ladies.

Section "A" of Tour.

On Sunday morning, June 18, the party will leave London in the morning for Banbury and thence by motor-coach *via* Sulgrave Manor to Leamington for luncheon. In the afternoon there will be a motor-coach drive through the Shakespeare Country, Warwick, Stratford-on-Avon, and Kenilworth, to Birmingham.

On the Monday there are to be works visits in the Birmingham area, followed in the evening by a dinner, given by invitation of the Birmingham Branch of the Institute of British Foundrymen.

Tuesday will be devoted to works visits in the Birmingham area, and at Derby during the afternoon. In the early evening the visitors will

(Continued on page 54.)

From the 2,500 or more columns of editorial matter published in the Journal in the past twelve months, these items have been picked as the most important events of the year.

In 1938 these were—

NEWS HIGHLIGHTS

Recorded

MONTH by MONTH

January

THE New Year's Honours List contained the names of four industrialists prominently associated with the control of foundries—Lord Nuffield (Morris Motors) was created a viscount; Sir Percival Perry (Ford Motors) was made a baron; knighthoods were conferred upon Mr. Charles Bruce-Gardner (Armstrong-Whitworth Securities) and Mr. William Reavell (Reavell & Company).

BY a new agreement, Cleveland blast-furnacemen's wages were no longer related to the net average selling price of No. 3 G.M.B. pig, production of which had dwindled to vanishing point. Basic iron was adopted as the index in a new formula.

THE International Ferro-Silicon Syndicate, due to expire at the end of 1937, was prolonged for another four months.

A 68-TON ship casting was sent to the Clyde by Brightside Foundry & Engineering Company, of Sheffield.

ORDERS worth £1,200,000 were secured by Clyde shipbuilders in the month.

AN aluminium rotary furnace, claimed to be the largest in Europe, with a 5-ton-a-day capacity, was started by E. Hind (South Bank), Limited.

MR. ARTHUR J. WARD, J.P., assistant managing director of Thos. W. Ward, Limited, Sheffield, died after 56 years with the firm.

ABOUT 80 new members were elected at the meeting of Council of the Institute of British Foundrymen.

THE death occurred of Mr. W. Noake, one of the founders of The Institute of Vitreous Enamellers, and a member of Council from its inception.

February

MR. GEORGE PATE, O.B.E., completed his 25th year as manager of the famous Carron Company.

CRANE, LIMITED, opened extensive new laboratories at the Nacton Works, Ipswich.

FULL production of aluminium at Kinlochleven was resumed, after two months' reduced operation caused by water shortage.

THE Thomas Turner Gold Medal of the Birmingham University Metallurgical Society was awarded to Dr. H. W. Brownsdon for original research.

DR. KARL LOEVENSTEIN, head of the Skoda Works, died in Prague, aged 52.

PREVIOUS records for size and number of exhibitors were broken at the Engineering Section of the British Industries Fair at Birmingham. Furnaces, refractories and raw materials were the principal exhibits of interest to foundry executives. Visitors exceeded 156,000.

DAVY & UNITED ENGINEERING COMPANY, of Sheffield, received a big order for steelworks plant from the Soviet Government.

SEVERAL outsize castings were in the news. An 80-ton cast steel mill housing made by English Steel Corporation was despatched to Ebbw Vale Works. A 19-ton single-piece cast-iron propellor was cast by Smith & Company (South Shields) in their Holborn Foundry. A cast-steel ship rudder, weighing 20 tons, was delivered by the Wolsingham Steel Company to the Wallsend shipyard of Swan, Hunter & Wigham Richardson, Limited.

RICHARDSONS, WESTGARTH & COMPANY, LIMITED, the North Eastern Marine Engineering Company, Limited, and George Clark (1936), Limited, passed a scheme for amalgamation.

PAPERMAKING machinery weighing 700 tons was being shipped to South Africa by Bertrams, Limited, the Edinburgh engineers, who had been at work on the job for 11 months.

March

MR. R. R. STOKES, head of Ransomes & Rapier, Limited, was elected M.P. for Ipswich.

THE new British Standard Specification for High-Duty Iron Castings (No. 786/38) was published, together with a revision of the Specification covering general grey-iron castings (No. 321). The strength figures for the high-duty iron are placed at a minimum of 12.5 to 15 tons per sq. in. tensile for grade 1, 15 to 18 tons for grade 2 and 18 to 22 tons for grade 3 (according to size of bar).

(*Continued on next page.*)

INTERNATIONAL CONGRESS IN LONDON

(*Continued from page* 53.)

proceed to Matlock, where they will dine as the guests of the East Midlands Branch of the Institute of British Foundrymen.

Wednesday, June 21, will be taken up with more works visits in the Derby area, whilst in the evening the Sheffield Branch of the Institute of British Foundrymen is staging a social function.

Thursday will be spent visiting works in the Sheffield area, and in the evening there will be an informal reception in Manchester.

Friday will be spent visiting the Manchester district works, followed by a dinner given by the Lancashire Branch of the Institute of British Foundrymen.

There are works visits also on the Saturday morning, and in the afternoon there is either a visit to Chetham's Hospital—a famous boys' school housed in XVth Century buildings—or the John Ryland's Library, which contains rare and costly books and manuscripts.

Those not participating in the second week of the tour may return to London.

Section "B" of Tour.

The visitors will leave Manchester on Saturday evening, June 24, at 5.05 p.m. for Oxenholme and Windermere.

Sunday morning is to be free, but at about 4.0 p.m. a tour will be made of the Lake District, including Ambleside, Grasmere, Thirlmere and Derwentwater, to Keswick, where visitors proceed by train for Glasgow.

The whole of Monday, June 26, will be given up to a steamer trip down the Clyde, and a theatre party, but on Tuesday works visits will be resumed, followed by a reception in the evening.

On Wednesday, June 28, the party leaves Glasgow for Edinburgh for a day devoted to sightseeing.

A journey to Newcastle occupies Thursday morning, and in the afternoon Tyneside works are to be inspected. A dinner as the guests of the Newcastle Branch of the Institute of British Foundrymen is scheduled for the evening.

The whole of Friday, June 30, is to be devoted to works visits in the Newcastle area, after which the party returns to London by the "Coronation," one of the fastest trains in the world.

Works Visits in Provinces

It is expected that participants in the Post-Congress Tour will be able to make their selection of works visits from the following firms:—

Birmingham and District.—W. & T. Avery, Limited; the Austin Motor Company, Limited; Midland Electric Manufacturing Company, Limited.

Derby and District.—Qualcast, Limited; Ley's Malleable Castings Company, Limited; Rolls Royce, Limited; Stanton Ironworks Company, Limited; Bamfords, Limited; International Combustion Company, Limited.

Manchester and District. — Metropolitan-Vickers Electrical Company, Limited; Mather & Platt, Limited; Craven Bros. (Manchester), Limited.

Glasgow and District.—Babcock & Wilcox, Limited; Harland & Wolff, Limited; G. & J. Weir, Limited; the Carron Company; Glenfield & Kennedy, Limited; the Singer Manufacturing Company, Limited.

Newcastle-upon-Tyne and District.—Sir W. G. Armstrong Whitworth & Company (Iron-founders), Limited; C. A. Parsons & Company, Limited; North Eastern Marine Engineering Company, Limited; Priestman Collieries, Limited; Wallsend & Hepburn Coal Company, Limited.

Sheffield and District.—English Steel Corporation, Limited; Firth-Vickers Stainless Steels, Limited; Hadfields, Limited; Davy & United Engineering Company, Limited.

THE HOME OFFICE A.R.P. Department has officially approved the Guest Keen Baldwin type of shelter construction, an example of which was constructed on Clapham Common and presented by the company to the London County Council last month.

NEWS HIGHLIGHTS

(*Continued from previous page.*)

THE Institute of Metals held its 30th annual meeting in London, when Dr. C. H. Desch was installed as the new President in succession to Mr. W. R. Barclay. The membership totalled 2,166 at the end of 1937. It was announced that in the future the Institute would share office and other accommodation with the Iron and Steel Institute at 4, Grosvenor Gardens, London, S.W.1. The platinum Institute of Metals Medal, offered by the Mond Nickel Company, was presented to its first recipient, Sir William H. Bragg, O.M., F.R.S.

THE Import Duties Advisory Committee announced an application for the removal of pig-iron from the free list.

THE Institute of British Foundrymen appointed Mr. John Bolton as assistant secretary.

THE Surtees Memorial Gold Medal (senior grade) was awarded to Mr. A. M. Campbell, and the Silver Medal (junior grade) to Mr. John Allen. Both candidates were attached to J. & G. Weir, Limited. The Director of Education for Glasgow made the presentation of the medals at a meeting of the Scottish Branch of the Institute of British Foundrymen.

AT THE annual meeting of the Foundry Trades' Equipment and Supplies Association, held in London, the officers were all re-elected (with Mr. A. C. Turner as President). The meeting decided to support a Foundry Trades' Section of the Engineering and Marine Exhibition in September, 1939.

A 37-TON roll was cast in "Adamite" by R. B. Tennent of Coatbridge, to be followed by a 50-ton roll.

AN IMPORTANT agreement between the National Light Castings Ironfounders' Federation and the Ironfounding Workers' Association and the National Union of Foundry Workers in regard to the payment of workers for castings spoiled by bad metal was revealed in the annual report of the Ironfounding Workers' Association. Membership of the Association at the end of 1937 was 11,880, and the funds totalled £39,750.

MR. PAUL SCHWIETZKE, of Düsseldorf, was elected President of the International Committee of Foundry Technical Associations. Dr. Guido Vanzetti, of Milan, was elected Vice-President.

THE British Iron and Steel Federation held its annual dinner in London, the company numbering 1,400. The chief guest was the Rt. Hon. W. S. Morrison, Minister for Agriculture and Fisheries, deputising for Sir Thomas Inskip, Minister for Defence.

THE import duties on certain iron and steel products, which were reduced in July, 1937, because of exceptional demands for steel in this country, were restored to their previous level at the end of the month.

MR. T. H. PARROTT, chairman and managing director of Belliss & Morcom, Limited, died at the age of 71, after more than half a century's association with the firm, and 25 years as managing director.

ORDERS for rolling stock worth £9,000,000 were placed by the L.P.T.B. with Gloucester and Birmingham firms.

April

THE Low Moor Iron Company, Limited, decided to discontinue the manufacture of cold-blast and special pig-irons at Low Moor, Bradford, and the whole of the works was acquired by Thos. W. Ward, Limited, for breaking up.

MR. H. SANDRÉ became President of the French Foundry Technical Association.

TAYLOR BROTHERS, of Sandiacre, celebrated their 80th anniversary.

FROM 25,000 entrants, Mr. Charles Rayner, of Bristol, was selected as the winner of the slogan competition organised by the British Ironfounders' Association, and received a prize of £100.

MR. J. K. SHANKS, of Cruickshank & Company, was fêted by his colleagues upon relinquishing the chair of the Scottish Ironfounders' Association. He was succeeded by Mr. Gourlay.

MR. T. TYRIE, B.Sc., was appointed Superintendent of the Scottish Laboratories of the B.C.I.R.A., replacing Mr. H. Cowan, who resigned to enter industry.

AT a Council meeting of the Institute of British Foundrymen, held in Sheffield, 59 persons were elected to the various grades of membership.

THE new mechanised foundry of R. A. Lister & Company, Limited, of Dursley, was inspected by Press representatives.

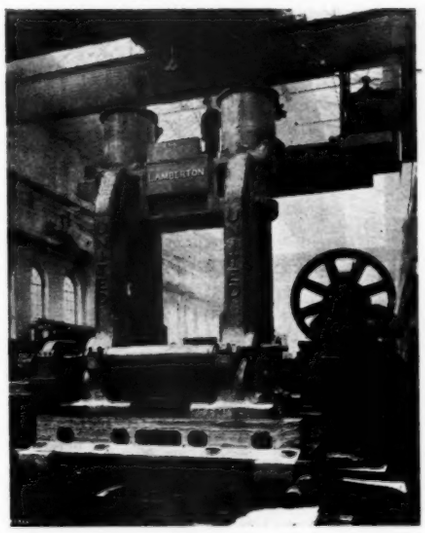
SIR HAROLD HARTLEY was re-elected chairman of the British National Committee of the World Power Conference.

THE total number of furnaces in blast was 118, a decrease of 15 from the December quarter.

May

THE Welsh Engineers' and Founders' Association announced that, following negotiations, 1,500 men in South Wales would receive holidays with pay.

80-TON CAST-STEEL MILL HOUSINGS



THE HOUSINGS OF THIS SLABBING MILL FOR THE EBBW VALE STEELWORKS WERE CAST BY THE ENGLISH STEEL CORPORATION, SHEFFIELD. THEY WEIGH OVER 80 TONS EACH. THE CASTINGS WERE DESPATCHED TO AND MACHINED BY LAMBERTON & COMPANY, LIMITED, OF COATBRIDGE, AND THE MILL WAS COMPLETELY ERECTED IN THEIR WORKS BEFORE DELIVERY TO EBBW VALE.

LORD DUDLEY presided over the Spring Meeting of the Iron and Steel Institute, in London. A Symposium on Steelmaking was the outstanding feature of the Proceedings. Dr. Desch was awarded the Bessemer Medal.

THE great Empire Exhibition staged at Bellahouston Park, Glasgow, was opened by His Majesty the King, accompanied by the Queen.

THE 37th Annual Luncheon of the British Acetylene Association was held under the presidency of Mr. E. S. Parnwell.

DR. PAUL D. MERICA, Vice-President of the International Nickel Company of Canada, was awarded the John Fritz Medal.

THE death was reported of Mr. W. J. Molyneux, the President of the Birmingham Branch of the Institute of British Foundrymen.

THE Midland Ironfounders' Association held its first annual dinner under the chairmanship of Mr. A. E. Hurst, J.P.

MR. F. S. RUSSELL presided over the 19th annual banquet of the Refractories Association of Great Britain.

AUGUSTS, LIMITED, of Halifax, celebrated their silver jubilee.

MR. F. A. LORENZ, of Chicago, was awarded the Joseph F. Seaman Medal.

UNDER the auspices of the Institute of British Foundrymen, a golf competition was held at Matlock. The *grand prix* was won by Mr. William Scott, of Newcastle.

HEADED by Dr. Everest, Branch-President, London foundrymen toured the West of England, visiting the foundries of the Great Western Railway; Newman Hender; Westinghouse Brake; and Petters, of Yeovil.

LIEUT.-COLONEL JOHN COLVILLE attained Cabinet rank

THE Foundry Pig-Iron Producers' Association announced no change in pig-iron prices to the end of the year.

THE new steel foundry and tube works at Jarrow were opened by the Duchess of Northumberland.

THE deaths occurred of Dr. J. W. Mellor, F.R.S., the first President of The Institute of Vitreous Enamellers; Dr. Stroud, of Barr & Stroud, and Mr. James Dyal, a director of T. W. Ward, Limited.

THE light-castings industry adopted the holidays with pay system.

June

THE International Mechanite Metal Research Institute held a conference in Glasgow.

THE 35th Annual Conference of the Institute of British Foundrymen was held at Bradford under the Presidency of Mr. Joseph Hepworth, J.P., M.P. There were 370 delegates attending. Mr. W. B. Lake, J.P., and Major R. Miles, of Middlesbrough, were elected Vice-Presidents. The E. J. Fox Medal was awarded to Mr. J. E. Hurst, and the Oliver Stubbs Medal to Mr. S. E. Dawson. Amongst the many Papers presented were contributions from Dr. Mackenzie (U.S.A.), Mr. Guertler (Germany) and Mr. G. G. Gauthier (France). About a dozen works visits were included in the programme.

MR. MARSHALL POST was elected President of the American Foundrymen's Association, and Mr. Henry S. Washburn Vice-President.

DR. C. C. PATERSON was elected President of the Institute of Physics.

THE death was recorded of Mr. J. R. Hyde, Past-President of the Sheffield Branch of the Institute of British Foundrymen.

THE 18th annual meeting of the British Non-Ferrous Metals Research Association was held at the Savoy Hotel, London.

AN International Engineering Congress was held at the Empire Exhibition, Glasgow.

AN 85-ton steel casting—a mill housing—was despatched from Coatbridge to Ebbw Vale.

July

THE Iron and Steel Institute and the Institute of Metals jointly acquired separate accommodation in the same house at Grosvenor Gardens, S.W.1, but the library is now a conjoint affair.

THE National Physical Laboratory opened its gates to several hundred visitors on the occasion of the annual inspection.

THE Factories Act came into force, involving radical changes in many directions.

THE Duke of Kent visited steelworks in Sheffield, and at Thomas Firth and John Brown's Atlas Works saw a 60-ton open-hearth furnace tapped.

ARCHIBALD BAIRD & SON, of Hamilton, informed us that 22 heats of steel were produced in a 2-ton Tropenas converter in 5¾ hrs.

A CONSIGNMENT of 25 steel ingot casting bogies weighing over 250 tons, for the Turkish Government steelworks at Karabuk, were despatched from Sheffield.

EACH of 105 employees who had completed 35 years service with Metropolitan-Vickers Electrical Company, Manchester, was presented by Sir Felix Pole with a watch or clock.

MR. J. LÉONARD, on account of health, decided not to continue as President of the Belgian Foundry Federation. He was succeeded by Mr. G. Moressé.

THE Research Committee of the Institute of Welding issued its first Progress Report.

I.C.I. METALS announced its decision to embark on a major scheme of development in the manufacture of light-metal alloys.

MAJOR F. A. FREETH, O.B.E., research manager of Imperial Chemical Industries, Limited, since it was formed in 1926, retired from that position. He is a Past-President of the British Cast Iron Research Association.

THE new liner "Mauretania" was launched at Birkenhead.

August

THE Clyde Alloy Steel Company constructed a new laboratory at their Motherwell works.

THE Report of H.M. Chief Inspector of Factories disclosed 192,539 industrial accidents in 1937, 1,003 being fatal.

MR. DAN AVEY resigned from the position of secretary-treasurer of the American Foundrymen's Association. Mr. R. E. Kennedy (technical secretary) was appointed secretary, and Mr. E. O. Jones treasurer.

INCREASING unemployment among patternmakers, caused principally by lack of orders in engineering and shipbuilding, engaged the attention of the United Patternmakers' Association.

A CARILLON of 44 bells, weighing 18 tons in all (excluding frame, etc.), the individual bells ranging from 5½ tons down to 12 lbs., was demonstrated at Gillett & Johnston's bell foundry at Croydon. They were for Grace Cathedral, San Francisco.

THE New Zealand Government placed orders in this country worth £200,000 for steel and engineering products.

THE British Association, holding their annual meeting in Cambridge, visited Kryn & Lahy's steelfoundry at Letchworth.

MR. ALFRED HUTCHINSON, immediate Past-President of the Iron and Steel Institute, died at the age of 72. A year before he was principal guest at the Institute of British Foundrymen's annual banquet at Derby. He was formerly chairman of the Skinningrove Iron & Steel Company.

TWO gifts of £10,000 each were made by Sir Robert Hadfield to the Metallurgical Laboratories bearing his name at the Applied Science Department of Sheffield University.

THE death occurred of Mr. W. E. McCalla, a well-known figure in the vitreous enamelling trade, in which he was one of the pioneers

September

THE International Foundry Congress was held in Poland for the first time. A small party of British delegates attended, the uncertainty of the political situation discouraging several people from attending. Despite a certain feeling of apprehension among all parties, the Congress was an undoubted success, due to the magnificent organisation by the Polish Foundrymen's Association, under its President, Mr. C. Gierdziejewski. There was an attendance of 350. The opening meeting was held in Warsaw (the number of Papers presented was 36), and then followed a six-day tour of Poland, ending in the closing meeting of the Congress at Cracow. A very varied series of foundries was visited during the Congress, and private hospitality by the hosts helped to make the event a memorable one for visitors. At a meeting of the International Committee on Testing Cast Irons, held in Warsaw, under the chairmanship of Mr. J. Léonard, it was decided to invite Mr. J. E. Hurst to become President. Another meeting, that of the International Committee of Foundry Technical Associations, elected Dr. Guido Vanzetti as President of that Committee for 1939.

THE annual cricket match between the Institute of British Foundrymen and the Works Managers' Association (Birmingham Branch) resulted in a five-wicket victory for the foundrymen, who thus became holders of the Lichfield Trophy.

THE new Master Cutler of Sheffield was Mr. A. J. Grant, managing director of Thos. Firth & John Brown, Limited.

DR. T. SWINDEN was awarded the M. C. James Gold Medal of the North-East Coast Institution of Engineers and Shipbuilders.

THE death occurred of Mr. William R. Barclay, one of the outstanding authorities on the metallurgy of non-ferrous metals and alloys. He was managing director of Henry Wiggin & Company, and consulting metallurgist to the Mond Nickel Company. He was President of the Institute of Metals in 1936 and 1937. He was awarded the O.B.E. for distinguished services during the War, when his knowledge was especially valuable to the Ministry of Munitions.

THE largest liner in the world, "Queen Elizabeth," was launched by H.M. the Queen at Clydebank. The liner called for the production of some of the largest steel castings made.

October

A SMALL party of members of The Institute of Vitreous Enamellers made a tour of some of the principal enamelling plants in the U.S.A.

THE Import Duties Advisory Committee intimated that certain types of foundry machinery, not made in this country, might be imported duty-free.

WEST Riding of Yorkshire foundrymen presented a silver cup to Mr. J. Hepworth, M.P., as a memento of his presidency over the first annual convention of the Institute of British Foundrymen to be held in the area.

THE projected autumn meeting of the Iron and Steel Institute in New York had to be abandoned because of the crisis. The meeting instead was held in London, and was the occasion of the presentation of the Third Report of the Steel Castings Research Committee.

PROF. R. H. FOWLER, who was to have assumed Directorship of the National Physical Laboratory, was released at his own request from the engagement on account of health reasons. Dr. C. G. Darwin was therefore appointed Director.

THE bye-laws of the Institute of British Foundrymen were altered at the resumed annual general meeting (adjourned from June) held in Manchester.

IT was decided to prolong the International Ferro-Silicon Syndicate until the end of September next.

THE prominent railway engineer, Sir Henry Fowler, died. He designed the "Royal Scot" and other locomotives, and had presided over the Institution of Mechanical Engineers, the Institution of Locomotive Engineers, and the Institute of Metals.

THE fifth annual conference of The Institute of Vitreous Enamellers was held in London at the end of the month, under the Presidency of Sir Harold Hartley. The banquet was attended by many distinguished guests, including Sir David Milne-Watson (who proposed the toast of the Institute and the industry) and Sir William Larke (Director of the British Iron and Steel Federation). Two Papers were discussed—one by Dr. Martin and Mr. J. G. Pearce on scientific aids to control, and the other by Mr. J. E. Hurst and Mr. W. Todd on metallic abrasives. The social events, in addition to banquet and dance, included a theatre party and a trip to Windsor.

SIR ROBERT MOND died in Paris on October 22.

November

NEWS was received of the formation in Melbourne of the Australian Institute of Foundrymen.

THE "Berengaria," 52,000-ton liner, was bought for breaking up at Jarrow.

WITH the death of Mr. Sydney Gimson, the Institute of British Foundrymen lost one of its Past-Presidents. He was occupier of the chair of the then British Foundrymen's Association at the time of the outbreak of war in 1914, although he had actually retired in 1909 to devote himself to public affairs. He was 78.

A PROPAGANDA meeting in Liverpool to attract new members from that centre was held by the Lancashire Branch of the Institute of British Foundrymen.

A JOINT meeting of the London and Sheffield Branches of the Institute was held in London. One of the Papers dealt with the powder metallurgy of iron, by Dr. W. D. Jones, the other with welding, by Mr. V. G. Pearson.

THE First Report of the Committee on High-Duty Irons for General Engineering Purposes was presented to the Institution of Mechanical Engineers, by the Reporter to the Committee, Mr. J. G. Pearce.

WILLIAM JACKS & COMPANY announced that, from the beginning of 1939, their business would be converted into a limited company.

December

THE Lancastria Club provided the occasion for a small international gathering of foundrymen at its thirteenth annual dinner, held in London. Mr. Frank S. Russell occupied the chair.

THE British Ironfounders' Association, in conjunction with the British Bath Manufacturers' Association and the National Light Castings Ironfounders' Federation, held its annual dinner in London.

ELECTRIC-FURNACE pig-iron (0.025 per cent. P, 0.02 per cent. S and 2.5 per cent. T.C max.) was added to the import-duties free list.

AN internationally-known figure in the foundry industry, Mr. E. Ronceray, of Paris, died in his 70th year. He will always be remembered for his work in connection with the education of young foundrymen, as he created the Paris Foundry High School. Well known in this country, he was elected an honorary member of the Institute of British Foundrymen in 1922, his membership of the Institute dating back to 1909. He was honorary member also of the American and the Czecho-Slovak Foundrymen's Associations. The American body also honoured him with the Whiting Gold Medal.

AN order for 77 miles of large steel pipes, worth £500,000, was received in this country from Port Elizabeth, South Africa.

FOUNDRY PIG-IRON price reductions, to operate from January 1, were announced. The zone rates were cut by 10s. per ton but no period of stabilisation was laid down. A wide range of steel products was also the subject of price reductions.

AN Armaments Advisory Panel of business men was formed by the Government.

THE London Branch of the Institute of British Foundrymen for the first time invited ladies to its annual dinner, which was followed by dancing and a cabaret.

MIDDLESBROUGH and Newcastle members of the Institute of British Foundrymen, the party numbering 120, paid a visit to the steel foundry of Thomas Summerson & Sons, of Darlington.

A NEW Admiralty metallurgical laboratory was opened in Sheffield by Sir William Bragg.

THE Earl of Dudley was re-elected President of the B.C.I.R.A. at the annual meeting in London. Mr. H. B. Weeks, for many years the Association's Chairman of Council, was elected to honorary membership. Steady all-round progress was recorded in the annual report, and several distinguished guests were present at the luncheon.

THE London Iron & Steel Exchange was wound up at the end of the year.

A new production peak has been attained in—

AUSTRALIA

By

DANIEL CLARK

Commonwealth Steel Co., Ltd., Waratah, N.S.W.

SINCE emerging from the harrowing years of depression, Australia's secondary industries reached a new peak in 1938. Bringing into play the vigour, optimism and high resolve of youth, their struggles in the slough of despond were of shorter duration than most of the older nations, and once on the highway of recovery, they have since progressed unabatedly.

As 1938 approached its close, however, there were signs of a slight recession, though of a lesser order perhaps than published statistics have revealed in respect of Great Britain and the United States of America. But what of the future? The unsettled conditions prevailing in Europe make it difficult, if not impossible, to predict with any degree of certainty, but, assuming nothing untoward occurs in world affairs, it seems reasonably safe to assume that the latter half of 1939 will show an upward tendency, sufficient perhaps to bring the full year not greatly under the values attained in 1938.

By a national decree, the export of iron ore from Australia was prohibited as from July 1 of last year. This step was considered necessary by the Government advisers, who reported that the available supplies were definitely limited. Completed figures reveal that in 1936-37 iron ore exports from South Australia reached 432,000 tons, a fair proportion of which, incidentally, went to the United States of America. Statistics for the year ended June 30, 1938, show a considerable falling-off.

Progress in Heavy Industries

The progress made during the last few years in the metallurgical industries in Australia has been truly remarkable, and indicates very clearly the solid foundations upon which her secondary industries are being built. With world experience as a guide, she has in some instances even surpassed the practice of other countries, whilst the efficiency resulting from the courageous and far-sighted administration of those controlling the heavy-industries group is such that there is reason to believe that Australia may be competing successfully in the world's markets for raw, semi-finished and finished steel products in the not too distant future.

INTERIOR OF THE HEAVY FOUNDRY OF BRADFORD & KENDALL, LIMITED, SYDNEY.

The expansion which has taken place and which is still continuing is definitely and clearly revealed from Government sources, which indicate that, in the year 1931-32, the production value of what was designated the "heavy industries" was approximately £50,000,000, while for 1935-36 it had jumped to £105,000,000, a figure which is certain to have been exceeded in 1938.

Co-operative Action

Contributing to this state of affairs, though only in a very minor degree, is the Bureau of Steel Manufacturers of Australia. This body was formed in 1923 under the chairmanship of Mr. Essington Lewis, chief general manager of the Broken Hill Proprietary Company, Limited, and its membership comprised what was termed "direct steel manufacturers." The purpose of its formation was to promote and protect the trade interests of steel producers, but not in any way whatever to fix prices or interfere with healthy competition. It was felt there were many matters of common interest which could be dealt with in a spirit of co-operation, such as standardisation of sections, the exchange of technical information and discussion of technical problems, etc., and that such action would help to place firmly on its feet an industry essential for the natural expansion and well-being of Australia and her people as a whole, and fit her to fulfil her function as custodian of this important outpost of the Empire.

(*Continued on page 58.*)

TYPICAL STEEL ROLLS CAST BY THE BROKEN HILL PROPRIETARY COMPANY, LIMITED, AT THEIR NEWCASTLE WORKS, N.S.W.

MANGANESE-STEEL BUCKETS FOR GOLD DREDGING, CAST AND ASSEMBLED BY THE COMMONWEALTH STEEL COMPANY, LIMITED, WARATAH, N.S.W.

High-efficiency foundries serve the Rand mines in—

SOUTH AFRICA

By

NOEL B. HOBBS

SOUTH AFRICA has many progressive industries, and the founding industry is expanding as fast as any of them. This expansion, however, is purely localised, in so much as it is confined almost entirely to the mining areas of the Witwatersrand in the Transvaal. There are, of course, foundries operating in some of the ports and harbours, but they are specifically excluded. As most of the foundries are situated on the Rand it would seem pertinent to assume, as most people do, that these foundries with their machine shops are entirely supported by the flourishing gold-mining industry. This, however, is not strictly true; although most of the work turned out by these foundries finds its way into the mines, railway companies (South African and Rhodesian), mining companies further north, and in general all other industries which require cast parts for spares command the service of the Witwatersrand foundries.

Labour Conditions

The South African foundry differs from the United Kingdom foundry in two major respects: (1) Labour conditions, and (2) *modus operandi*. The foundry industry in common with other South African industries is fortunate in having relatively cheap native labour, which enables the plant to be run with a fairly low "unskilled wage bill." Some of the natives work an eleven-hour shift, but this depends upon the department in which they are employed and on the shift, whether day or night. The foundry "boys," as the natives are called, start the day shift at 6 a.m. and work through to 6 p.m., with an hour from 12 to 1 p.m. for lunch. The moulders, coremakers, etc., "knock off" at 4.40 p.m., so that the day-shift boys have an hour and twenty minutes to continue with the clearing up of the shop. In practice, however, the teeming continues until after 5 p.m. The skilled artisans and apprentices start work at 7 a.m., an hour after the "boys." These conditions of shift prevail winter and summer alike. Boys working the night shift start at 10 p.m. and carry on without a break to the start of the morning shift. These are the general conditions which prevail in most of the Witwatersrand foundries, but in order to give an impression of the type of foundry the author will discuss the foundries of one of the leading firms on the Rand.

This particular firm operates three foundries and a machine shop; then there is, of course, the usual patternshop and metallurgical laboratory. The type of foundry has largely been determined by the rapid service required by the gold producers, who tend to pay more regard to immediate delivery than quality. This, of course, does not imply that slovenly work is turned out, for in some cases the mines, like the railways, impose strict specifications on the metal and casting itself. The speed is made up

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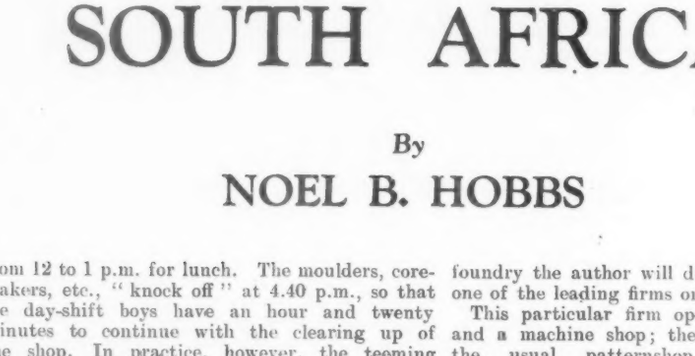


THIS VIEW OF THE CAST-IRON FETTLING BASE AND SAND-BLAST PLANT OF A MODERN FOUNDRY IN THE TRANSVAAL ILLUSTRATES HOW CLIMATIC CONDITIONS MAY DICTATE RADICAL CHANGES IN LAYOUT.

AUSTRALIA

(*Continued from page 57.*)

Foundry Conditions

Referring now to the foundry industry, in sympathy with the advancement in practice and technique in other parts of the world during recent years, it is found in Australia that designers are regarding the product of the foundry with a kindlier eye than has been their wont. This change of heart is encouraging and represents the result of prolonged efforts on the part of those endeavouring to place the industry on a higher plane. The result is that certain progressive designers are exploring first of all the possibilities of utilising castings, where normally they would have gone straight ahead and furnished specifications and drawings for forgings only.

Another feature accruing from the new slant on steel foundries is that a better type of employee is being attracted to the industry, the effect of which must in the course of time make for greater initiative and progress. A number of instances could be quoted where castings have replaced forgings, but for the purpose of this review only two—steering arms and knuckles for agricultural tractors—need be cited. These items were formerly produced as drop forgings, but by choosing the correct grade of steel, casting and then heat-treating properly, splendid results were achieved, and users have evinced no desire to revert to forgings. Thus it would appear as if the progress shown in the foundry sphere during 1938 from the standpoint of improved practice will continue, and before the close of another year, one may witness the circle of its influence still widening.

Among comparatively recent developments in Australian foundries is the manufacture of parts required for gold and tin dredgers. Formerly imported, units such as tumblers, buckets, etc., are now being successfully produced for use in the Commonwealth and contiguous countries.

In quite another sphere is the production in Melbourne of precision-cast water- and gas-tight manhole covers and frames by the Elkington Gatic patented process. Moulded in iron from precise patterns, the castings are reputed to be stress-free and have an accuracy in the "as-cast" condition practically equal to a machine-tool finish.

Goldfields a Source of Foundry Activity

During the past three years or so, much money has been spent in erecting new plants and modernising old ones in the various goldfield areas. Nearly all of this work has been done within the Commonwealth, and has brought considerable activity to those foundries producing crushing and milling equipment. The past year, however, saw the bulk of these extensions completed, and present portents are that this year will be mainly devoted to making good the wastage rather than furnishing new installations.

The progress being made abroad in "Meehanite" metal castings has been watched with interest and its potentialities investigated, with the result that six foundries are now making this improved iron in Australia under licence.

This outline, though brief, may convey some slight idea of the progress being made in Australia's foundries. They have no tradition—that is in progress of building—but every endeavour is being made in common with kindred industries to perform the various tasks in such a way that posterity will be proud of the heritage that is theirs, and in turn it is hoped that the coming generations will play their part in assisting Australia to fulfil her destiny, that of becoming one of the great industrial nations of the earth.

SOUTH AFRICA

(*Continued from previous page.*)

in the patternshop, where accurate skeleton patterns are necessary for quick transit to the foundries. Great care, however, is taken over patterns for repetition work.

In order to meet such specifications which may be imposed upon the job in hand, the firm runs an excellent metallurgical laboratory, which operates mainly in connection with the non-ferrous and steel foundries. Most of the cast-iron work demanded by the mines is of a fairly low-grade iron having a largish grain size at fracture. Occasionally alloy irons, such as nickel cast iron, are required, and the firm is able to meet these requirements at a moment's notice.

Brass-Foundry Operation

The brass and bronze foundry is served by three natural-draft pit furnaces, a Morgan oil-fired furnace and a reverberatory oil-fired furnace. These furnaces are operated entirely by natives under the guidance of a "mixer" and the laboratory. The furnaces are located at one end of the shop, near the storage bins and chill casting area. All turnings and borings are stored in the bins after they have been cleaned by passage through a magnetic separator. Castings range in weight from a few ounces to four and a half tons, and may be cast in any alloy. The firm specialises in white metals and aluminium castings. The following gives an idea of the class of work:—Bearings, impellers, pipes, cocks, gear blanks, axle boxes, turbo-runners, all Sulzer pump parts, including barrel, etc. The foundry is, therefore, a jobbing foundry, and can produce any class of work so long as it is within the range of weight. All the small repetition work is done on moulding machines. After the cast the moulds are stripped, and the castings taken through to the fettling yards, where they are cleaned and finally sand blasted; they are then sent through to the machine shop.

Conditions in the Iron Foundry

The iron foundry is served by two cupolas, a 6 ton and a 4 ton, and two electric gantry cranes, a 12 ton and a 5 ton. On one side of the shop there is the sand plant, the core shop, the mould drying ovens, the furnaces and a light moulding bay. The main bay and the opposite small bay are all given over to moulding. One "boy" of long experience is in charge of the sand plant, and he is responsible for all the sand distributed throughout the floor. Should any doubt arise as to the condition of the sand, the laboratory takes charge until satisfaction is restored. In the day shift there are two "boys" operating the cupolas. The charges are made up and weighed in the scrap yard and are then raised by an electric hoist to the charging platform. The melting procedure is as follows:—Each morning the foreman makes a rough estimate of the metal required for the day's cast, and chalks up a number of lines on a board (many of the boys cannot read figures), corresponding to the number of charges required. As the charges go up the furnace "boy" crosses off the lines, and he also adds the necessary quantities of coke, pig and flux. At the end of each shift the furnaces are knocked out and repaired during the night by the night-shift "boys."

The shanking is also done by the "boys." Monorails are not used, because they are deemed unnecessary; and it is a fact that, with a fairly light ladle, two sensible boys can easily outpace a rail. The heavier ladles are taken by the overhead cranes. The range of work in this foundry varies from a few ounces to twelve tons, and any type of job is produced. Like the non-ferrous foundry, moulding is done in both dry and green sands. On the completion of the day shift, the moulds are knocked out and the castings taken through to the fettling area which runs at right angles to the foundry. The fettling shop is served by a 5-ton overhead travelling crane, sandblast, grinders and chisels, etc. Here again, the fettling is done entirely by boys, all of whom are in the charge of a foreman. The foundry is made of brick with two sets of glass windows about 10 ft. high running the whole length of the shop; the roof is of corrugated iron; thick glass would seem desirable, but it is impracticable as the South African workshop is at the mercy of the elements, severe hail and thunderstorms being frequent occurrences in summer.

Steel-Foundry Work

Of all the foundries the steel foundry is the most up to date. The layout is roughly as follows:—There are two bays side by side and under the same roof. The main bay is served by a 10-ton and a 5-ton crane, while the melting bay is served by a 5-ton crane with electro-magnet attachment. At the north end of the melting bay, next to the transformer house, is the 4-ton Héroult electric furnace. Space has been allowed for in case any addition is required to the melting equipment. At the back of the bay are the concrete bins which contain the sorted steel scrap of approximately known carbon and alloy (if any) content, and the heads and runners, etc. The ganister-lined ladles are also prepared in this bay. At the north end of the main bay is the sand plant, which is operated by three "boys," both day and night, under the supervision of the foreman moulder and the laboratory. Facing sand is prepared from virgin constituents and is made as required by the moulders. The backing sand is prepared from reconditioned material and is mixed and distributed throughout the moulding floor during the night. The sand is transported about the foundry in specially constructed bins which are handled by the cranes. Opposite to the sand plant is the core-oil plant, which produces a special mixture for the core sands. Next to the sand plant are the mould-drying stoves and core ovens. These are of a special design, having a sand seal to prevent heat escaping and fouling the bearings. The ovens are supplied with hot gases blown through them by a single-horsepower fan which is attached to the core ovens at the rear of the stoves. This part of the plant is also run by a native who has grasped the meaning of a pyrometer.

As the moulds are produced they are checked and loaded on to the bogey, which is drawn into the oven at the close of work. The oven is opened at 7 a.m. and the bogey unloaded; the moulds are then taken to the teeming bay, which is located directly in front of the furnace. The mould setters have about 4 hrs. in which to get the first batch of moulds ready for the melt due to be tapped at 11 a.m.

After the cast, if there be a heat-treatment furnace up to temperature the moulds are taken to the furnace where they are knocked out and the castings placed hot on the bogey. This practice is only carried out if the steel is of such a type that permits such a process. If no furnace is available the moulds are allowed to cool slowly, and they are transported to the knocking-out and fettling bays, where they are stripped of heads, gates, risers, etc., and in general made ready for their heat-treatment. There are two heat-treating furnaces, both of which are water-gas fired. The gas producer is located next to the largest furnace. Between the bogey tracks of the furnaces is the quenching tank, which was constructed for the water-quenching of the manganese steel, which is used so much by the mines. The fettling area is equipped with high-power swing and stationary grinders and all other equipment which is found in up-to-date foundries.

Furnace Operation

The plant produces about four alloy steels and the usual range of cast steels. The furnace is basic lined and is of the automatically-controlled type. The primary voltage in the transformer is 66,000 volts, which is stepped down to a range from 170 to about 88 volts in the secondary circuit. The furnace is run by a furnaceman and apprentice and three furnace boys; after slagging off when the bath is undergoing reduction, the boys are sent out on to the scrap heap to fill the pans—in the South African foundry everyone is kept busy.

The alloy steels which are produced are used for manufacturing crusher parts (manganese steel), shock-resisting skip wheels (chrome alloy steel), and various heat-resisting materials. The cast steels are used for wheels, cams, tappets, heads, sole-plates, base-plates, amalgam barrels, and the like. As can be imagined, a Rand foundry must collect some thousands of patterns; and this particular firm, after only 25 years of service, has amassed more than 30,000 patterns. Their storage is one of the few internal problems. A certain job may be required by one of the mines, and the pattern, if a large one, will entail some cost, hence it would be unprofitable to destroy the pattern, although ten years may lapse before the order is repeated. Patterns as a rule are made in plain deal, but those patterns for repeat orders are made in the more expensive mahogany.

In conclusion, it can be said that foundries in South Africa are working at an efficiency comparable with that of the average European foundry. This fact, no doubt, is due entirely to the cheap native labour and production which is necessary to supply the mines, etc. Mechanised foundries have not yet found their way into South Africa, but the matter is worth consideration.

World's Production of Steel Ingots and Castings in 1937

The subjoined table, which is reproduced from the Statistical Summary (Production, Imports and Exports), 1935-37, issued by the Imperial Institute, shows, in tons of 2,240 lbs., the world's production of steel ingots and castings in 1936 and 1937.

Producing country.	1936.	1937.
BRITISH EMPIRE.		
United Kingdom	11,784,600	12,984,000
Union of South Africa	244,200	279,700
Canada	1,115,779	1,402,882
India	865,770	895,229
Australia (†)	*	*
Total	14,700,000	16,300,000
FOREIGN COUNTRIES.		
Australia	411,790	639,457
Belgium	3,118,340	3,808,078
Czecho-Slovakia	1,514,014	2,278,000
France	6,602,150	7,794,997
Germany	18,459,495	19,535,339
Hungary	544,000	655,000
Italy	1,993,521	2,065,582
Latvia	2,554	2,855
Luxemburg	1,949,766	2,470,588
Poland	1,122,512	1,428,023
Rumania	216,606	235,495
Spain	463,583	165,354
Sweden	961,922	1,088,141
U.S.S.R.	16,338,200	17,149,000
Mexico	133,418	*
United States‡	47,767,856	50,568,701
Brazil	72,504	75,223
Japan	5,140,527	5,719,488
Korea	85,640	
"Manchukuo"	338,617	*
Total	107,200,000	116,200,000
WORLD'S TOTAL	121,900,000	132,500,000

* Information not available.

† Years ended June 30.

‡ Excluding steel castings which were produced by companies not manufacturing steel ingots.

The year-end brought brighter prospects to—

AMERICA

By

OLIVER SMALLEY

President, Meehanite Research Institute

THE year 1938 was a difficult one for the foundry industry in the U.S.A. Fortunately, the 1934-37 recovery had given industry as a whole an opportunity to rehabilitate, but the sudden collapse in August, 1937, culminating in the first half of last year to a level where business was in 1933, left most foundries unprepared, and the struggle for business has been unduly intense.

New Equipment

An exhibition of equipment was held at the A.F.A. Convention in Cleveland last May. As would have been expected with serious business troubles confronting the industry, there were no radical innovations in machines or equipment, although improvements and refinements appear to have been made in some proven equipment. Reducing cleaning costs, elimination of dust hazard and producing better working conditions seemed to have received most attention.

Moulding Machines

To meet the demand for greater safety in the foundry, the Champion Foundry & Machine Company, of Chicago, have equipped swinging squeeze heads on moulding machines. These have an automatic device which prevents the machine from functioning unless held in certain positions. The operator has to hold the head definitely in position with one hand while he manipulates the valve with the other hand.

Another safety principle is incorporated in moulding machines made by Wm. H. Nichols Company. The movement of the operating valve is controlled by an electrical contact. The operator has to use both thumbs to press two buttons simultaneously. In this manner his hands are removed from the potential danger zone.

Herman Pneumatic Machine Company has developed a portable jolt squeezer machine with an 18-in. by 24-in. table and equipped with a special locking device which holds the head definitely in position.

The International Moulding Machine Company is manufacturing six different sizes of core-blowing machines. The largest of these is capable of handling cores up to 160 lbs. Also, they are developing a blowing machine for blowing moulds. This apparatus is in the experimental stage.

The Haskelite Manufacturing Corporation, Chicago, Illinois, featured a new material for pattern and matchplates. The material is plywood faced on both sides by thin steel sheets. Advantages claimed are light weight, warp-proof, and great strength.

Ladle Equipment

The Whiting Corporation exhibited a U-shaped ladle for desulphurising cupola iron. It is said that this is 50 per cent. more efficient for sulphur removal than the standard teapot ladle, and also does this with less soda ash. This company also exhibited various sizes of cylindrical insulated-covered ladles highly efficient in retaining temperature of metal.

The Blystone Manufacturing Company have developed a sand-mixing unit in which the sand first is introduced to a revolving screen mounted above the mixing pan. In the pan the sand and any incorporated material are mixed and blended by a series of paddles mounted on a revolving shaft.

The Abrasive Company, Philadelphia, Pa., featured a high-speed grinding wheel operating up to 9,500 s.f.p.m., of low mechanical upkeep, and which prevents the sides and edges of the wheel from being chipped out at the centre hole when mounting or handling the wheel.

The U.S. Electrical Tool Company exhibited a new electric motor-driven high-speed grinder with instantaneous speed change, giving a constant speed increase for all wheel diameters as the wheel wears down, thus ensuring at all times maximum stock removal.

Steel Castings

With the dual purpose of increasing production, efficiency and improving the quality of production, the operating executives of the steel casting industry in America have been exchanging technical information in monthly meetings. This movement has been developed under the auspices of the Steel Founders' Society of America. These regional groups of operators have been very active, as may be demonstrated by the fact that the experimental work of Sims and Dahle on the use of aluminium for deoxidation purposes and at the same time maintaining high ductility values in steel castings, was checked on a commercial scale and proved correct by the operators of the Eastern Group.

There have been a number of worthwhile developments during the year. Perhaps the most outstanding is the Third Report of the Steel Castings Research Committee of the (British) Iron and Steel Institute, which contained studies on the fluidity of iron-carbon alloys and steels, the properties of copper-steel castings, a continuation of the work on the strength and ductility of cast steel during cooling from the liquid state in sand moulds, and a report of the Moulding Materials Sub-Committee.

During the year reports were made on the subject of design and the relief of stresses. A set of design rules that the engineer may follow in designing steel castings was presented by Briggs, Gezelius and Donaldson.

Studies on the effect of alloys and heat-treatments on the mechanical properties of steel castings were actively pursued during the year, with Malcolm presenting some interesting information on the effect of low temperatures on the properties of cast steel, and Stewart discussing the higher temperature properties of some alloy cast steels. Some long-needed information on the effect of mass upon the mechanical properties of cast steel was also presented by Briggs and Gezelius.

Interest is again being evinced in the centrifugal casting of steel. The method is well adapted to the production of gears and wheels. A number of high-alloy steel castings are also being produced centrifugally.

Extended application is being made of the composite cast-weld construction wherein a complicated structure is produced by welding a number of steel castings together. This broadening of the market of composite welded structures and steel castings is being extended to many new applications. In this regard engineers of the Ford Motor Company have announced that the utilisation of steel castings has been extended in that organisation so that 149 lbs. of steel castings are now used in every motor-car.

Moulding sands for steel castings manufacture have been studied during the year and some worthwhile information has been developed. Woodliff and Schuch have presented information on the properties of 33 sands which are being used in commercial steel foundries. The durability of sands was discussed by Schubert and some factors and methods of sand testing have been reported on by Walker and Buchanan.

Grey Iron Castings

Cupola operation was given special consideration at the Technical and Shop Sessions of the A.F.A. Annual Meeting. The cupola furnace was likened to a furnace for heating a house, the best results being obtained when the coke and iron charges are not too thick. The weight of the iron charge should be determined from the weight of coke used. For example, if 300 lbs. of coke are necessary to give a 6-in. layer of coke, and the melting rate is 8 lbs. of iron for 1 lb. of coke, then the weight of the iron charge should be 8 × 300, or 2,400 lbs. of iron—the correct weight of iron.

The melting rate of any cupola depends upon the burning rate of the coke and, of course, this is determined by the amount of air blown into the cupola. The thought of the meeting was that a definite tuyere area for a definite cupola diameter was not very important, although it was necessary to decrease the tuyere area from about 25 per cent. of the cupola area to about 16 per cent. as the cupola diameter increased. It was also emphasised that U-gauges and metering devices to a cupola were as important as those on the dashboard of a motor-vehicle, and very few would think of running a car without some device for measuring oil, fuel and speed, etc.

The formation of graphite in grey iron containing from 3 to 3.5 per cent. carbon and 2 per cent. of silicon has been studied by Bayles. He believes graphite flakes and phosphide eutectic are restricted by the size and distribution of the dendrites. The number of primary dendrites depends upon the carbon content. The size of the dendrites depends upon the rate of cooling. Addition of phosphorus, manganese and sulphur to pure carbon and silicon iron alloys has no effect on the dendritic spacing. Superheating over the range from 1,455 to 1,675 deg. C. has no observable effect.

"Physical Properties of Cast Iron in Heavy Sections" was a study by E. R. Young, V. A. Crosby and A. J. Herzig. In "The Relation of Microstructure to the Enamelability of Cast

(*Continued on next page.*)

AMERICA

(*Continued from previous page.*)

Iron," by G. H. Spencer-Strong (Baltimore, Md.), the four major defects caused in enamelling were given as blistering, hairlining, poor adherence and warping. "Risers or Gates for Some Special Non-Ferrous and Alloyed and High-Test Iron Castings," by C. Brisbois and A. E. Cartwright (Montreal, Canada), brings out the old idea of gating into the riser, using some form of skimming device to keep back the slag and dirt.

Malleable Iron Castings

Malleable iron castings during the past year have maintained their position in their many and varied applications, and, in addition, a number of new uses have been developed. Among other of the newer uses for malleable iron which have made appreciable headway during the past year, these may be mentioned: bridge railing posts and panels, highway guard-rail parts, highway construction parts such as expansion joint supports for uniting concrete slabs, park bench frames, stadium seat parts, etc. In the motor-vehicle field, an outstanding development has been the use of malleable iron of the pearlitic variety for camshafts and experimental work for its use as crankshafts.

On the whole, however, the past year in the malleable iron industry, as in general business, has been one of subnormal production. Well over half of the production is taken by the motor-vehicle industry. In the average American car about 120 lbs. of malleable castings are used; in consequence the trend of malleable casting orders follows closely that of the motor-vehicle output. There has been a tendency to redesign many farm implement parts within the past year, and an expansion of the use of malleable is expected.

In the way of advanced methods of manufacture, there has been a tendency of many producers in the industry to examine and revamp their production equipment, particularly annealing with respect to its efficiency during periods of low as well as high demand. Large-scale continuous equipment capable of efficient operation only in periods of high demand often does not justify its use in periods of subnormal demand. The general feeling is that it is to the interest of both the consumer and producer to install equipment that can be operated efficiently with prompt deliveries in periods of subnormal demand, and that appears to be the objective of many, rather than to over-equip when such equipment can be best utilised only during the peak periods of demand.

Acceleration of annealing time by open annealing has followed developments in annealing of bright drawn steel, adopting large gas-tight furnace units and using the controlled furnace DX gas, which is a product of combustion controlled within somewhat wide limits, extending from about 12 per cent. CO_2 on the one side to 10 per cent. CO on the other. For best control during malleablising, however, it has been found that a gas containing up to 12 per cent. CO_2 and no CO, or one containing as low as 5 per cent. CO_2 and 10 per cent. CO, gives best results. By this method a complete cycle of annealing takes something under 50 hours.

Parallel with this development has been the further trend toward the manufacture of special malleable irons of superior strength value, but nothing new in this direction has resulted.

The Future

Unlike the situation a year ago, business to-day is not suffering from over-expansion and has been definitely on the upgrade for the past several months. Industrial production last May was down to 76. It has risen spectacularly and is now above 100 and approximates where it was in 1926.

Steel operations have jumped from 35 per cent. a year ago to 63 per cent. capacity to-day, which is the highest rate since October, 1937.

The building industry is competing with the motor-vehicle industry as the chief contributor to the 1938 recovery. Recent building contracts are 75 per cent. ahead of 1937 and have reached the highest level since 1931. A total volume of contracts for 1938 of $3,500,000,000 compares with $2,900,000,000 for 1937. The prospect for 1939 in the construction field includes a rise of about one-third in residential buildings, commercial and public-utility construction, and a prospective doubling of factory construction which had been at a low level last year. A sizable increase during the first six to eight months is estimated with a possible decline in the later months of the year. Of significance and importance to the maintenance of the present recovery is the performances of this important heavy-goods activity.

The production of motor-cars and lorries for 1939 is estimated at 3,550,000 units, as compared with some 2,700,000 units for 1938, and barring some new threatened or actual economic cataclysm, this prognostication appears conservative.

Domestic orders for machine tools, which are considered a sensitive index for business, are on the increase.

Shipbuilding, both on naval and merchant account, is now at the highest peace-time rate in history. This means considerable castings business in the direct and indirect construction of the ships. For example, more than $3,000,000 is to be spent for machine tools and special equipment, of which castings will occupy a major share. The Government will spend over four

(*Concluded on page 63.*)

How foundries fared in—

FRANCE

By

HENRI SANDRÉ

President, French Foundry Technical Association

DURING the year 1938, the French iron-founding industry experienced great activity in respect of the manufacture of machine-tool castings. This is no doubt true of the whole world, but in France it was especially pronounced, as the demands of the re-armament programme were reinforced by the necessity to neutralise in some measure the effect of the legal reduction in working hours.

The use of low-carbon cast irons continues to expand, and they are made just as satisfactorily in the cupola as in either the rotary or the electric furnace, although the latter method is obviously popular in those regions where ample water-power is available for the cheap generation of electric current.

Generally speaking, pipe founders have gone over to the centrifugal process. The ordinary grey-iron foundry trade has not been too well placed. For instance, the railway companies have been parsimonious in the placing of contracts, whilst the building trades underwent what could almost be described as a crisis. The malleable ironfounders also suffered on the same scores.

The light-alloy foundries were extremely busy, as aircraft construction is becoming an ever-increasing consumer of their products. Efforts are also being made to increase the consumption of light alloys by the motor-vehicle and railway industries. The concerns making high-tensile brass castings for Admiralty and War Office use have been overwhelmed with work, but those manufacturing for the normal trade uses are not so well placed. Die-casters, however, are not too badly off for work.

Steel Foundries Busy

The steel foundries, for the reasons set out when dealing with high-tensile brasses, have had full order-books throughout the year. Electric steel is highly esteemed, and manufacturers have not been short of work. The cost of the plants for this type of production limits its use to firms of large dimensions. An increased demand has been noted for alloyed steel castings.

The price of pig-iron has been stabilised for many months, Longwy No. 3 being fixed at 598 fcs. per metric ton at the furnaces [67s. per ton]. France produces good-quality foundry hematite. There was a distinct shortage of steel scrap, as too great a tonnage had been exported during the last few years.

France is striving by all means possible to popularise the use of aluminium, as this metal is produced in large quantities within the Republic. The French foundry industry has always suffered from an acute shortage of highly-skilled men, in spite of major efforts made to train apprentices. Endless difficulties are encountered when endeavouring to attract youngsters to the moulding craft, which has unfortunately the reputation of being harder and dirtier than turning and fitting. This reputation cannot really be substantiated.

The mental outlook of the workpeople, which has been materially influenced by revolutionary communistic propaganda, has undergone a change for the better. The inherent common sense of the French citizen has won through and the incitement of the agitators has become merely an echo of its former volume.

Outlook for 1939

There is some hope that this year will bring about prosperity, based not on armaments but on the true needs of the country, amongst which are the following:—An increase in machine-tool output; the harnessing of water power, necessitating new electrical equipment; the revival of the building industry, and increased motor-vehicle production. Such activities would undoubtedly give a real impetus to the foundry industry.

As President of the French Foundry Technical Association, the writer sends his greetings, and those of the members, to his British confrères. The co-operation so long established between the technical associations of the two countries has been productive of many firm individual friendships—the true basis for an *entente cordiale*.

Foundries are distinctly progressive and versatile in—

CANADA

By

A. E. CARTWRIGHT

Metallurgist, Rbt. Mitchell Co., Ltd., Montreal

THE prosperity of Canada's foundry industry, like that of many other Canadian industries, is influenced in great degree by that prevailing in the United States. In general, upward or downward trends on the part of U.S. industry are reflected by similar tendencies in Canada. It can be noticed, however, that there usually is an interval of from three to six months or more before Canadian industries react to major industrial trends in the United States.

Canadian foundries are distinctly progressive and versatile, including, as they do, first-class founders of almost every metal and alloy in the foundry repertory. The variety and quality of castings required for such outstanding Canadian industries as nickel, copper, zinc and lead mining and smelting, gold mining and refining, asbestos mining, and pulp and paper making, have encouraged the Canadian founder to develop a quality of product and a regularity of supply to compete with the best production of the United States, Great Britain and other highly industrialised exporting countries.

Apart from the key industries mentioned, the Canadian foundryman supplies to a large extent the castings required by the Canadian railways, agriculture, oil refineries, textile, chemical, building, motor vehicle, food processing, and many other domestic industries.

General Position Defined

With the exception of certain large industries that operate their own production foundries, the Canadian foundries are not highly mechanised, that is, in the sense of continuous conveying, shake-out systems, etc. Of course, modern moulding machines, core-making machines, and Sandslingers are in wide use. The lack of elaborate continuous systems does not indicate lack of progressiveness, but is due, rather, to the varied character of the work handled. Quantity repetition work is quite scarce, while great diversity of alloys and casting designs is the rule.

Since this type of production entails costs generally higher than those of specialised foundries making similar castings in quantity in the United States or Great Britain (a difference frequently exceeding that of any tariff protection and higher transport costs for imported castings), it will be appreciated that the Canadian founder has to be ingenious and efficient in order to make the most of his advantage of more speedy service, and to supply castings of quite equal quality. These requirements are being creditably and increasingly fulfilled, and from this angle alone, the Canadian foundry industry is in a healthy condition.

Development Activities

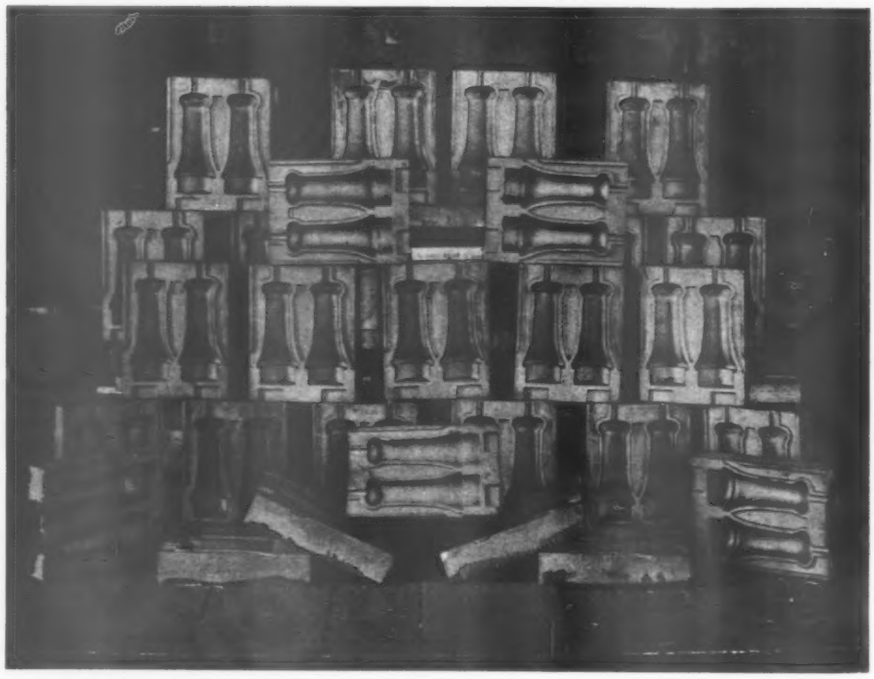
Great progress has been made in the metallurgy and production technique of high strength and alloyed cast irons. In Canada, as in other countries, cast iron has acquired a new and enviable status as a result of the careful study of the fundamentals of its production technology, and the intelligent use of additional alloying elements such as nickel, chromium, molybdenum, copper, titanium, etc.

The aid supplied to the foundryman by alloy and ferro-alloy producers in connection with publicity, systematic research and technical advice has proved of mutual value to all concerned, including designing engineers and the users of castings. The International Nickel Company is the outstanding example of this type of development effort, and their immense mining and smelting works at Coppercliff, Ont., has done notable service as a proving ground for the various alloys developed.

The pioneering of the use of alloyed martensitic white irons of the "Ni-hard" type in the mining industry has developed the use of these with great success in the form of liners for rod and ball mills, ore shutes, sludge pumps, scoops, etc. Much patient study of abrasion conditions and effects, and of metallurgical practice and foundry technique for their production, has been an essential requirement for attainment of an optimum balance of hardness and toughness, with absolute soundness of section necessary to withstand the severe service conditions.

Considerable light has been shed on abrasion problems encountered in the mining industry by the extensive research performed at the Ontario Research Foundation under the direction of Mr. O. W. Ellis, whose Paper on this subject, presented on behalf of the American Foundrymen's Association as an official Exchange Paper to the Institute of British Foundrymen for 1937 will be recalled.

Austenitic irons, mainly of the "Ni-resist" type, are also in enthusiastic demand by oil refineries, paper mills, chemical industries, etc., for their corrosion-resistant properties, and are equally popular by reason of their superior heat-resisting qualities for special furnace parts, melting pots, etc. Another very popular alloyed iron for heat-resisting service, notably grate bars and stoker links, contains about 1.5 per cent. nickel and 0.70 per cent. chromium. Manufacturers of stoves are increasingly substituting this composition, or some modification of it, for unalloyed iron in grates and other parts (that do not require to be enamelled) and profiting, in many instances, by being in a position to guarantee measurably longer life of the product for the slight additional cost.



A GROUP OF NICKEL-CHROMIUM CAST-IRON DIES FOR THE PLASTIC-MOULDING OF TELEPHONE RECEIVERS, MADE BY ROBT. MITCHELL COMPANY, MONTREAL.

Melting Plant

The majority of iron foundries operate with the cupola as the melting unit, although electric furnaces of both the direct and indirect arc type are profitably used by some. The attention that has been paid in recent years to the improvement in the quality of cast irons has

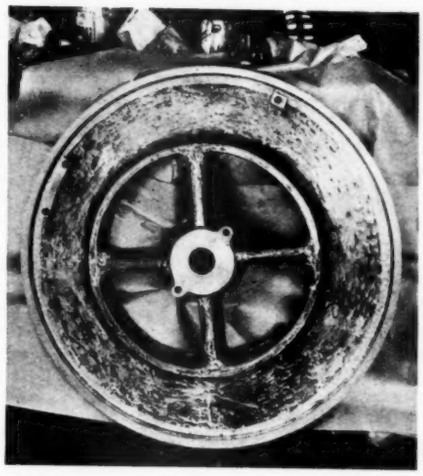
included considerable study of cupola melting methods and increasing use of special blast-control devices, mixing ladles and forehearths, soda-ash treatment, and technique of continuous tapping through front-slagging dam spouts. The steel foundries utilise either direct arc electric furnaces or the basic open-hearth furnace, with the exception of two foundries operating converters.

Extent of the Industry

There are, according to the latest figures available, 327 iron foundries (including 9 malleable iron and 39 stove foundries), 27 steel foundries, and 80 brass and bronze foundries operating in Canada. The majority of the pig-iron and coke consumed by these foundries is produced in Canada. (An informative review of the primary iron and steel industry of Canada appeared in THE FOUNDRY TRADE JOURNAL, November 24, 1938.) There are also adequate supplies of scrap metals and ingotted alloys domestically available.

Several large steel foundries are admirably equipped to produce castings of plain carbon steel, S.A.E. and similar classifications of plain and alloy steels, while high-manganese steel, heat- and corrosion-resisting steel castings are being produced by up-to-date methods of quite equivalent quality to imported products.

Among non-ferrous alloys, large quantities of tin-bronzes, with or without lead, zinc and phosphorus, are being produced as castings for bearing and acid-resisting services for all major and minor industries.



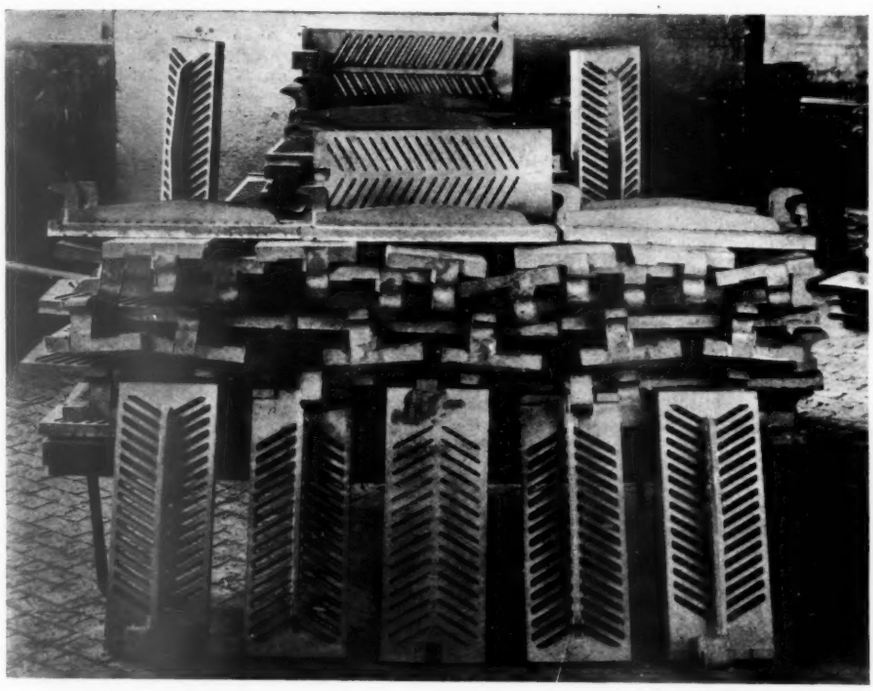
MONEL-METAL CASTING FOR CENTRIFUGE, WEIGHING 1,500 LBS., CAST BY ROBT. MITCHELL COMPANY, MONTREAL.

Increasing popularity is evident for cast Monel metal, nickel-silvers, silicon bronzes, manganese and aluminium bronzes, and heat-treated aluminium-base alloys. The more recently developed harder grades of cast Monel metal (the "S" grade, containing 3½ to 4½ per cent. silicon, and the medium "H" grade containing 2½ per cent. silicon) have attracted much attention by reason of their lessened tendency toward galling in high-temperature valve service. Nickel-silver is largely replacing nickel- and chromium-plated brass for ornamental and plumbing fixtures, and has also found favour in certain food processing plants. Silicon bronze of the type known as "PMG" bronze has demonstrated its superiority under conditions involving cavitation corrosion, and some large turbines have recently been produced in this alloy. High-strength manganese and aluminium bronzes have a large demand.

In conjunction with the increased activity of development of aircraft manufacture in Canada, the production of high-quality cast and heat-treated aluminium-alloys is gaining momentum. Most popularly demanded for this class of work are the 4 per cent. copper-aluminium alloy, solution-treated and aged, for structural parts, and "Y" alloy for pistons and cylinder heads. Silicon-aluminium alloys, both "modified" and heat-treated, are also in demand for various parts.

The company with which the writer is associated, besides producing castings of all the alloyed cast irons and non-ferrous alloys referred to above, are producing cast and heat-treated aluminium-alloy aircraft castings for structural and engine parts under their own rigid technical control and X-ray inspection.

With present indications that world conditions in general are improving, and industrial conditions in the United States are on the up grade, Canadian industries, including the foundry industry, have every reason to look forward to continued healthy development.



THESE SINTERING GRATES USED IN THE INTERNATIONAL NICKEL COMPANY'S SMELTER AT COPPERCLIFF, ONT., WERE CAST IN NICKEL-CHROMIUM CAST IRON ("MITCHALLOY D") BY ROBT. MITCHELL COMPANY, MONTREAL.

A GROUP OF ROD AND BALL MILL LINERS, SCOOPS AND GRINDER PLATES, CAST IN "MITCHALLOY B" (NI-HARD).

AMERICA

(*Concluded from page* 61.)

billion dollars in industry during the next four months, and this will prove an important stimulant well into the year.

Employment

Increased business activity since June has reduced unemployment by 1,000,000 workers, but over 9,000,000 are still idle. About one-quarter of these who lost their jobs in the 1937-38 depression have now gone back to work.

So far as the foundry business is concerned, some 10 to 15 per cent. improvement over 1938 is anticipated over the months ahead, but whether this improvement will broaden into a more continuous and healthy activity depends largely upon recovery of the heavy industries—electrical, railway equipment and machinery, farm implement, etc.—which at the moment are disappointing. Copper buying has been at a new low level for the year.

So far as general business improvement is concerned, some irregularity is expected over the winter months to readjust the present rapid upward pace, but by spring resumption of the uptrend is anticipated, continuing generally and moderately through 1939. That is the overall outlook for business in the U.S.A. with the usual variations, of course, for particular lines.

As to whether the recovery will carry into and beyond 1940 and develop into a healthy activity of all industries depends upon the complex questions of political reform, war, the unanchored state of world currencies, and the nationalistic trade policies of the various nations. England is looking to America to lead the way to industrial recovery, but it is felt here that the foreign situation is probably the biggest drag on further expansion of business in this country. Every element essential to a full recovery is present save one, and that is *confidence*.

Diminished natural and industrial resources of—

CZECHO-SLOVAKIA

By

PROF. DR. MONT. FR. PISEK

President, Czecho-Slovakian Foundrymen's Association

TOWARDS the end of 1937, the year in which Czecho-Slovakia seemed to have definitely surmounted the economic crisis and was enjoying reasonable prosperity, even the most confirmed pessimist would not have envisaged how disastrous 1938 would be for the country.

The beginning of the year was marked by full employment for most branches of Czecho-Slovakian industry, not only on account of orders for armaments but mostly due to the requirements of private consumers.

The increasing political insecurity intentionally provoked in some parts of the frontier districts inhabitated by Germans was darkening the political horizon to such an extent that on May 21 it was considered necessary for defence to bring the Czecho-Slovakian army to a higher numerical strength. This action, although removing a good number of people from industry, had, on the whole, no deleterious influence, for factories went on working to full capacity, the decreased staff being offset by the greater effort everywhere put forward. Industry in the frontier districts however suffered by constant political disturbances.

Nobody could presume that a State which among all countries of Europe cared best for its minorities should be forced by the four Great Powers to an unjust and dishonourable capitulation touching the very root of its life.

The distribution of the population was such that only a small part of the German population lived in purely German agglomerations, but the major part of the German inhabitants of the country penetrated into purely Czech districts and lived with the Czech populations in full agreement. The greater part of the German citizens did not desire the political changes that were forced upon the State.

Whilst Czecho-Slovakia was actively making preparations for the defence of its territory came the heavy blow from Munich, the dictatorial decision of the four Great Powers which has no precedent in history and which was even signed by an " allied " State.

The Reduced Area

The size of the territories ceded and the number of the inhabitants are set out in Table I.

The loss of the territory is 29.25 per cent., with 4,704 districts. The new conditions have in no way simplified the frontiers. Some industrial towns in Czecho-Slovakia, as Plzen, Moravská-Ostrava-Vítkovice, etc., are situated directly on the frontier, and are connected with the Czecho-Slovakian territory only by a narrow strip of land.

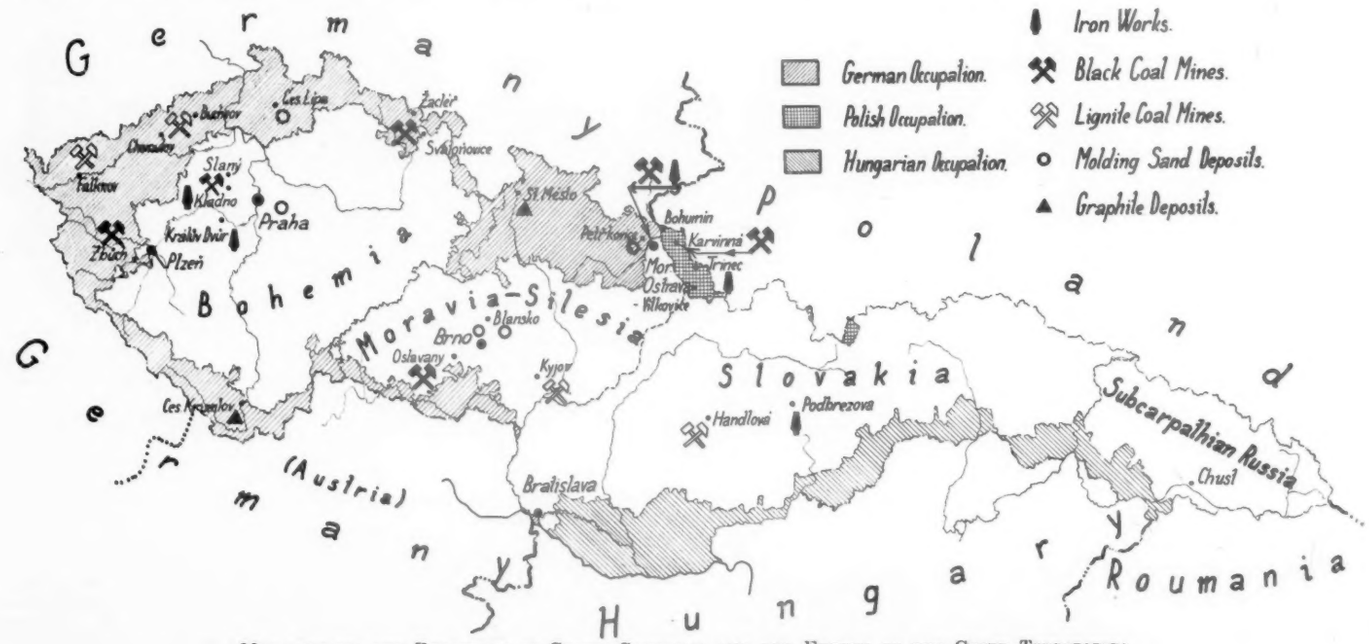
The main railway lines are cut in many places; for example, to go from Brno to Prague it is necessary to cross the ceded territory twice; from Prague to Moravská-Ostrava, three times. To go from Prague to the new capital of Subcarpathian Russia, Chust, it is necessary to cross the frontier six times.

TABLE I.—*Ceded Territory and Number and Division by Nationality of Population.*

Ceded to :	Square kilometres.	Total inhabitants.	These inhabitants include :			
			Czecho-Slovak.		Ruthenians.	
			Total	Per cent.	Total.	Per cent.
Germany	28,296	3,615,833	718,934	19.88	1,459	0.04
Poland	972	235,569	128,405	54.50	123	0.05
Hungary	11,830	1,027,450	288,803	28.10	35,261	3.43
	41,098	4,878,852	1,136,142		36,879	

The present Czecho-Slovakian Republic, after deducting the ceded territories, now has the following population :—

		Per cent.
Czecho-Slovaks-Ruthenians ..	9,040,000	= 92.24
Germans	337,830	= 3.45
Hungarians	100,000	= 1.03
Jews	126,300	= 1.28
Poles	4,203	= 0.04
Different nationalities		= 1.96



MAP SHOWING THE RESOURCES OF CZECHO-SLOVAKIA AND THE EXTENT OF THE CEDED TERRITORIES.

For the 3.45 per cent. Germans, the new Czecho-Slovak Republic maintains, in addition to other schools, a university and two technical universities. Obviously, the loss of 29.6 per cent. territory and 33.42 per cent. inhabitants forms an important economic factor for both agriculture and industry.

In Czecho-Slovakia there now remains, of the former 13,560 km. of railways, only 8,802 km., or 65 per cent.; moreover, a proportional number of locomotives and carriages had to be handed over.

Agriculture and Forestry

No less than 38.90 per cent. of agricultural land and many acres of forests were taken. As a result, Czecho-Slovakia has been reduced from a wood exporting country to one which will have to import.

The loss of land for growing wheat, rye, oats and barley is not greater than the loss in population; but, on the contrary, that for cultivation of sugar beet and potatoes is smaller. In spite of the loss of very fertile land in both Slovakia and Subcarpathian Russia, conditions are that in the future the smaller state will have an excess of cereals; an excess of at least 50,000 to 60,000 tons of wheat will be available.

TABLE II.—*Distribution of the Population by Vocation.*

	Number.	Percentage of total.
Agriculture and forestry ..	3,690,360	37.6
Industry and trade	3,137,210	32.0
Commerce and banking	721,790	7.4
Transport	551,400	5.6
Public services	625,300	6.4

Coal

The greatest loss of all is that of coal. Of the total production of lignite of 18,000,000 tons, the Czecho-Slovakian State loses 16,000,000 tons. Of the total production of ordinary coal (17 million tons) 9.3 million tons, or 55 per cent., have been lost. The whole district of Karvinna and a great part of the Moravská Ostrava basin have been ceded. From being an exporting country, coal will now have to be imported to the extent of a milliard kc. per annum. Only about 55 to 60 per cent. of the former capacity of industry now remains.

Industrial Losses

All trades have not suffered to the same extent. The greatest losses were shared by the textile industry as no less than 443 factories have been ceded; the glass industry, losing 299 factories; the workshops for polishing semi-precious stones (260 workshops); musical instruments (115) and the ceramic industry, which lost 85 factories. Important losses were also suffered by the paper industry, including the cellulose factories and those making paper for the rotary presses, and the chemical industry, where the largest factories have been included in Germany.

Whilst the greatest part of the textile industry was concentrated along the frontier, there are some very important centrally situated centres such as Prague, Humpolec, and Brno. The cession of territory has created many difficulties in this industry, because in many cases the spinning mills are separated from weaving mills and the weaving mills are separated from the finishing mills and printing works. In some branches the reconstituted Czecho-Slovakia will have an adequate or an excess capacity, but in others it will be necessary to build new factories. Fortunately the loss of these textile factories does not menace the export trade, since most of the factories did not work at full capacity.

Sugar and Brewing Industries

In the sugar industry, one of the largest and most efficient in Europe, a total of 19 raw and white sugar factories were lost out of 116 factories, *i.e.*, 16.38 per cent., which represents about 30 per cent. of its productive capacity. It is calculated that the total decrease of sugar production in the 1938-1939 season will be 30 per cent. compared with the previous year.

The brewing industry has lost about 120 breweries, or 32.4 per cent. The output of the lost breweries represents about 2,200,000 hectolitres, 25 per cent. of the 1937 production. The export business should not be disturbed, as nearly all the well-known breweries remain in Czecho-Slovak territory.

Power Houses

After coal, a very regrettable loss is that of electric power. A very delicate situation has been created, as the various generating stations were connected by means of long-distance cables from the frontier territories, inland or *vice versa*. For instance, the great power station at Ervenice (now ceded), with a capacity of 70,000 kw., chiefly supplied Prague and the centre of Bohemia. Again, near Moravská Ostrava lies, in what was purely Czech territory, but now in Germany, the new power station at Trebovice, having a capacity of 60,000 kw. and supplying a great part of Moravia, Silesia and partially Slovakia with the electric energy. The total loss of electric energy is of the order of 350,000 kw.

Glass and Leather Industries

Though the loss by cession is very serious, Czecho-Slovakia still remains outstanding as a glass and ceramic-ware exporting country. The major losses are in plate and mirror glass production—a matter of 70 per cent. and 80 per cent. respectively, all the large mechanised plants having disappeared, whilst in the hollow-glass trade the losses are serious. In some branches, however, in a short time this industry will be rebuilt, and before long the export of glass will be resumed.

Though the best-known ceramic works were nearly all situated near Karlsbad, there are some small establishments in the new Czecho-Slovakia. Backed by ample kaolin deposits, experience and foreign connections, these are expected to recreate the "Czech china" industry.

The leather industry has not suffered too badly by the territorial changes, as the tanneries were concentrated for the most part in the interior of the country. In the territory now ceded to Germany there is nearly 30 per cent. of the total production of box calf and about 50 per cent. of goat skin. The Sudeten area, however, did furnish raw cow-hides of a first-rate quality. A great loss has been marked in the production of pine tannin, of which yearly 4,000 to 5,000 wagons were produced.

The electrical engineering industry has not been materially affected, as most of the large works have remained in Czecho-Slovakia. Any losses incurred will be made good by a more intensive electrification of the country. The losses in the mechanical engineering industry have been comparatively few; the largest engineering works, such as Skoda, Vitkovice, C.K.D., Brünner, are nearly all in Czecho-Slovakia. The Skoda works, however, have lost their shipbuilding yards at Komárno.

The manufacture of textile machinery has been completely lost, but, in connection with the production of machine tools, only one well-known firm, "Plauert," of Warnsdorf, has been lost. Recently, however, some modern large-capacity machine-tool works were built in the interior, and because of this machine tools will still command a considerable business for Czecho-Slovakia.

Out of the six motor-vehicle factories, only one, the Tatra works, having a capacity of 25 per cent. of the total Czecho-Slovak industry, has been lost. Two carriage and wagon works have gone, but because of the large capacity of the residual industry, this loss will not be felt.

The production of semi-finished products has not been felt to any great extent. In copper and brass semis, such as wire and wire ropes, two large works have been lost, but there are still five factories having a total capacity of 1,800 wagons per annum. The loss in consumers is of the order of 60 per cent.

Iron and Steel Industry

In addition to a number of smaller works, the following well-known ironworks have been ceded to Poland:—

The Trinec concern, with its four modern blast furnaces, the largest of which has a daily output of about 650 tons, and its steelworks and rolling mills, including the continuous billet rolling mill with its record European output. The capacity of these works is about 475,000 tons of pig-iron, 500,000 tons of raw steel and about 450,000 tons of rolled products. Its iron mines, however, remain in Slovakia.

The ironworks at Hahn in Bohumín (Oderberg), with one derelict blast furnace, a rolling mill and a tube rolling mill (Ehrhardt's process). This works produced about 60,000 tons of raw steel, 40,000 tons of rolled products and 10,000 tons of tubes.

The iron and wire drawing works of Bánská a hutní spolecnost of Bohumin, a modern concern producing 300,000 tons of wire per year.

To Germany the following works have been ceded:—

The Mannesmann works at Chomutov, having a yearly capacity of about 80,000 tons of weldless tubes.

The Mannesmann works in Svinov, with a somewhat lower capacity.

The Poldi works at Chomutov, well known for its production of special steels; these are the new works of the Poldi concern, as the original works are at Kladno in Czecho-Slovakia.

TABLE III.—*Number of Foundries in Czecho-Slovakia Before the Munich Agreement, and Number Ceded.*

	Grey iron.		Grey iron + non-fer. met.		Grey iron + steel.		G rey iron + malleable.		Grey iron + non-fer. met. + alum.		Grey iron + non-fer. met. + steel.		Grey iron + malleable + steel + non-fer. met. + alum.		Grey iron + malleable + steel.		Steel.		Non-fer. met.	
		Loss. Per cent.		Loss. Per cent.		Loss. Per cent.		Loss. Per cent.		Loss. Per cent.		Loss. Per cent.		Loss. Per cent.		Loss. Per cent.		Loss. Per cent.		Loss. Per cent.
Before Munich ..	114	—	106	—	4	—	8	—	60	—	4	—	2	—	2	—	2	—	130	—
Lost by Munich ..	51	49.7	53	50.0	1	25	2	25	11	18.33	1	25	—	—	1	50	1	50	69	49.23

In spite of these losses the existing territory of the Republic continues to be an industrial and not a purely agrarian country. The distribution of the population of Czecho-Slovakia according to vocation is shown in Table II.

The best-known ceramic works were nearly all situated near Karlsbad, there are some small establishments in the new Czecho-Slovakia. Backed by ample kaolin deposits, experience and foreign connections, these are expected to recreate the "Czech china" industry.

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Poor home and export demands experienced by—

BELGIUM

From PAUL ROPSY,

President, Belgian Foundry Employers' Federation

Steel Castings

THE year under review has not fulfilled the bright expectations which might have been engendered in the light of 1937 developments. Political conditions in general have not been of such a nature as favours an upward trend of business. The series of disturbing political events which, beginning shortly after the New Year, culminated in the crisis of last September, made foreign buyers very cautious, and even the great efforts undertaken to restore some state of tranquillity to Europe do not appear as yet to have been effective in dispelling this atmosphere of prudent restraint.

Even in distant export markets, important new building programmes—of railway equipment, for instance—have been annihilated by war. Other countries, though enjoying peace, have drastically reduced their spending schemes, due to failure of harvests or simply impelled by a spirit of economy.

Rolling stock and bridge builders, who are the natural source of orders for steel foundries, have had a slack period, and in consequence the situation of the foundries has been very quiet. Moreover, the Belgian railways, also under the effect of adverse financial conditions, only gave out a modicum of new orders.

Selling prices for castings therefore were brought very low, in an effort to secure employment; a noticeable decrease in the price levels of raw materials was helpful to this end, but unfortunately prices for coal and coke remained rather higher than those ruling in the foreign markets, due to a probably exaggerated protection of the national mining industry. Profits, therefore, have been very low, all the more so because many prominent foundries, having engaged in extensive research work on the elaboration of high-quality steel, have had to continue these investments in spite of momentary adverse conditions. This commendable pioneer work is giving very encouraging results theoretically, and it may be confidently hoped that, as the present conditions will result in the survival of the fittest, these firms will be able to reap their deserved reward as the situation develops into greater stability, when long-delayed needs for equipment will again have to be satisfied.

Stove and Range Foundries

Foundries manufacturing heating and cooking ranges have, during the past year, experienced conditions distinctly less favourable than in 1937. The home market has not escaped the various influences which tend to lower consumption. The number of the export markets is not reduced, but the business offered by those which are under the influence of French monetary conditions has been considerably contracted in volume.

Prices have remained fairly stationary, but for too many lines they are still distinctly lower than the level which allows a reasonable return on invested capital. On the other hand, the employers' federation catering for the stove grate foundry owners has not registered any progress during 1938. On the technical side, the year under review has not witnessed any innovation meriting special attention.

Pipe and Roll Founding

So far as the domestic market is concerned, the first six months reacted favourably, because of the public works policy pursued by the Government, but in the second half-year a policy of retraction was inaugurated, and as a result progressive deterioration set in, and continued to the end of the year. The export trade was virtually non-existent because of the competition, which made prices extremely low in foreign countries.

For the first three months of the year there was a well-sustained demand for rolls. From that

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CZECHO-SLOVAKIA

(*Continued from page* 65.)

However great the loss of the iron industry might be, there still remains in Czecho-Slovakia a number of large ironworks which normally worked well below their maximum capacity, and their production will in a few years be considerably increased.

Foundry Industry

The foundry industry in all its branches worked to full capacity until the end of September. Immediately after Munich, the production fell to about two-thirds, but in the later months of the year the activity increased again, constantly and steadily.

The consequences of "Munich" are not so unfavourable for the foundry industry as for the other industries. As will be realised from the above, the chief customer of the foundries, the engineering industry, has remained for the greatest part in new Czecho-Slovakia, and there are adequate raw materials for its needs.

Pig-iron.—A source of foundry pig-iron has been lost at Trinec, but this will not be felt very much, as Vitkovice and Prazská zelezárská can easily supply the whole foundry industry.

Coke.—The entire production of foundry coke of the best quality is concentrated around Vitkovice, where the best coal for this purpose is to be found, and all of this has remained in Czecho-Slovakia.

Refractory materials of the best quality are still available, as, generally speaking, the situation has not been changed.

Graphite.—This useful commodity has been completely lost; the important deposits in Moravia and Bohemia have been ceded to Germany. This brought about an immediate shortage, which is to be remedied by immediately reopening the old graphite mines now remaining in Czecho-Slovakia.

Moulding Sands.—In spite of the loss of the well-known deposits at Huldschein and in Northern Bohemia, there are still adequate supplies, which are to be supplemented by the opening up of fresh quarries.

The loss of foundries and their nature in the ceded territories is shown in Table III. There were in Czecho-Slovakia before "Munich," 298 grey-iron foundries, of which 22 had an annual output in excess of 2,500 tons; 52 medium-sized concerns with outputs ranging from 1,000 to 2,500 tons yearly, and 224 small foundries making less than 1,000 tons. Since Munich there remain 16 large foundries, 44 medium ones, and 138 small concerns (a total of 198). Numerically considered this makes 33.55 per cent., but according to capacity 28 per cent. at the most.

Of the 14 steel foundries, four were taken representing about 20 per cent. of the total production. In the case of the 12 malleable iron foundries only three were in the ceded territory, representing a capacity loss of only 15 per cent.

The 130 non-ferrous foundries which were in the ceded territory represent a numerical loss of 36 per cent., but their output cannot be even roughly evaluated, as they included a number of quite insignificant concerns. Of the really big foundries only two have been lost. The output loss may be put down at about 20 per cent.

The development of the engineering industry, especially in respect of the production of machine tools, brought about the extension of some foundries in 1938 and the creation of a new foundry specially equipped for the production of castings for machine tools, having a capacity of about 3,000 tons per year.

Ferro-Vanadium Production

Among the most important innovations made in the Czecho-Slovakian foundry industry was the production of ferro-vanadium by the Vitkovice concern. This concern now produces ferro-vanadium from vanadium-bearing blast-furnace slags. The slag is heated with salt according to the formula:—

$$V_2O_3 + 2NaCl + 3/2O_2 = 2NaVO_3 + Cl_2$$

The product is washed, and from the lye the V_2O_5 is precipitated with a content of 92 per cent. V_2O_5; to eliminate alkalis and sulphur it is washed. The dried product is mixed with the hammer scales and by the Thermit process it is reduced to ferro-vanadium.

Conclusion

In 1938 Czecho-Slovakia made a great sacrifice to the whole world by accepting the terms of the Munich agreement, by which the thousand-year old frontiers were abolished. This heavily hit the economic life and structure of the country. Czecho-Slovakia anticipates the possibility of her rehabilitation and that her place in the world will be guaranteed as before.

When steel is passed through the fire, its qualities improve and this rule applies not only to steel but also to nations and industry. On this are based the hopes of the new Czecho-Slovakia and its industries.

There was no marked business fluctuation in—

SCANDINAVIA

By

T. C. EARNILL

THE industrial conditions in the Scandinavian countries showed a very marked improvement in January, 1937. It continued steadily during the first nine months of the year, and towards the last quarter it came to a standstill, and the new year of 1938 began with much uncertainty.

Statistically, 1937 was the best industrial year for Denmark, Norway and Sweden since 1918, and it is apparent that these countries were among the first to recover from the world depression. The reasons for this early recovery may be found in the abundance of really skilled workmen, well-organised labour conditions, and the co-operative organisations, which combined have saved these countries from excessive unemployment and other serious national expenditure.

Neither have the Scandinavian countries been subject to any extreme boom, where undue expenditure on expansion is necessary to meet the demand during such peak conditions. The countries have been spared from those national business fluctuations which always involve a readjustment after the boom has ceased.

Because of the well-consolidated conditions in the Scandinavian countries, they were prepared to take advantage of the steady, healthy business recovery that started in 1937. At the beginning of 1938, business conditions seemed somewhat questionable, although shortly after the New Year business experienced a firmer condition, which it maintained throughout the year. The last two months, however, have shown some falling-off, caused by the uncertain political condition in other parts of Europe, and the fluctuation in the prices of raw materials.

The above remarks refer to the more general industrial conditions in the Scandinavian countries, and the following figures deal more specifically with the activity of the iron and steel trades.

Sweden

Using the level for 1936 as equal to 100 per cent., foundry employment was 98 per cent. in the first quarter of 1937; 102 in the second quarter; 113 in the third; and 114 in the last, while in the first quarter of 1938 it was 101, and in the last three quarters was estimated to be about 112 per cent.

The output of Swedish pig-iron in 1936 amounted to 578,225 tons, whilst the foundries produced 977,358 tons of castings. The export of Swedish pig-iron amounted to 90,146 tons in 1937, and it is expected to exceed 100,000 tons in 1938.

Sweden's total export of foundry finished and semi-finished products in 1937 amounted to 257,800 tons. The final figures for 1938 have not yet been compiled, although they are expected to be somewhat larger than 1937.

Denmark

Table I sets out the number of working hours a day in the Danish iron and steel industry for 1937 and 1938, and reveals a very stable condition:—

TABLE I.—*Working Hours in the Danish Iron and Steel Industry.*

	1937.	1938.
January	368,258	386,310
February	375,634	388,293
March	384,395	392,810
April	398,515	401,215
May	409,087	405,519
June	416,769	407,929
July	405,212	394,986
August	406,468	400,913
September	405,927	406,705
October	411,415	—
November	405,807	—
December	403,362	—

The unemployment figure for skilled moulders in 1937 was 13.9 per cent. For the iron and steel trade as a whole the unemployment figure for 1937 was 13.2 per cent., and in 1938, 13.3 per cent. This unemployment percentage may be considered as the necessary extra help needed in peak periods, although 50 per cent. of these men may be unable to work because of old age or temporary disablement. The iron and steel industry in Denmark paid out about £600,000 in wages in 1937, and about £700,000 in 1938. There are now 60,000 men employed in the iron and steel industry, compared with about 30,000 in 1933.

The last two years have brought many new industrial laws, which have put a great many restrictions on the manufacturer, while in most cases the laws protect the working class and place the financial burden on the employer. Systematic overtime has been abolished, no man being permitted to work more than 48 hrs. a week. In case of emergency repair work where a man is required to work more than the usual 8 hrs. a day, he cannot be paid overtime, but has to work the same number of hours less the following week. Whenever possible any irregularity in the factory working hours, or special work that has to be done when the factory is otherwise not working, must be reported in advance to the local factory inspector, and his permission given before such work can be undertaken.

The law requires that all factory workers must have two weeks' holiday every summer, with full pay, or an equivalent according to the length of service in the company, in case he has been employed less than a full year. For workers who have no permanent employment, and might be working a few days on a job here and there, and even in different parts of the country, such men are paid a certain percentage of the pay received, in State holiday stamps, bought at any Post Office. The employer is compelled to provide the stamps in addition to the wage paid the worker. The workers have a book in which the employer pastes the stamps, and writes the wage paid the worker in cash, and how many hours the man has been employed. The worker can collect the amount of money paid in on his holiday book any time during the summer months, but he is compelled not to accept any work during his holiday.

In cases where the employees are engaged in supervisory work and are receiving a monthly salary, they must have a written contract with the firm. The first three months are a mutual probationary period. After this the contract automatically becomes binding, and the firm is compelled to give no less than three months' notice before such an employee can be discharged. After three years' service in the same firm he is entitled to four months' notice, after six years he must be given five months, and, finally, after nine years' work with the firm he is entitled to six months' notice, with full pay, before the firm can discharge him from their service.

On the other hand, an employee can resign from the firm at any time after one month's notice.

In the case of the death of an employee, the firm is compelled to pay the family of the deceased his usual wage for the following three months. Beside these advantages and protections, this class of employee is also entitled to two weeks' holiday and usually a certain percentage of his wage is put aside in an old-age pension fund.

Apprenticeship Legislation

A new law regarding the training of apprentices has also been launched recently. The boys have to serve from four to five years to learn the moulder's trade, usually beginning at the age of from 14 to 15 years. The employer has to pay for their technical education at the municipal evening classes, and before they are granted their certificate as a moulder, they have to pass an examination by a State board, and exhibit a certain piece of work produced by themselves under the supervision of the board. Usually the moulders are given a complicated casting to make, with a great deal of core work, and the young men must also make the cores, do the pouring, and finally clean the casting. In case of failure in passing the test, the apprenticeship may be extended. The new law permits the young man to sue the company for neglected training and instruction during the contracted period. This may require the employer to pay expenses caused by the extended apprenticeship, in addition to the usual wages earned.

This condition has placed the employer in a very difficult position, and has in many cases been the cause of neglect to take in the necessary number of young men to maintain sufficient skilled moulders in the future.

Because of the above conditions, the foundry executives are now looking towards increased mechanisation in the shops. The use of moulding machines has lately been of great interest in the Scandinavian foundries, and some of them are now installing sand-conditioning machinery, as well as endless-belt conveyors for moulds throughout the shops. In some extreme cases, foundries are producing small castings without the use of moulding sand, by the help of specially trained workers who, perhaps, never before the day they started working in the mechanical foundry had seen the melting and pouring of molten metal.

Due to the many emigration restrictions, it is difficult for the workers to find employment in other countries. The Scandinavian countries have arranged an exchange of moulders, so that an equal number are permitted to work a year. In this way it is possible for the skilled workers to gain greater all-round experience than they otherwise would get within the country itself.

The especially severe import restrictions which have been issued, and which are also controlled by the Government, have given some new work

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Seaports are the chief foundry centres in—

THE FAR EAST

By

SYDNEY SIMPSON

PRESENT conditions in the Far East make it difficult to give a real synopsis of the status of the foundry industry. In the British colonies trade is still flourishing, and in the Philippine Commonwealth, too. Unfortunately, it is extremely difficult to learn of the state of affairs in China itself. In Shanghai trade is resuming some semblance of normality, but of Hankow and Canton little can be said. There is no need for this article to deal with Japan, whose foundry industry was the subject of an admirable article in THE FOUNDRY TRADE JOURNAL a year or two ago.

Before dealing with the foundry industry itself, it is necessary to compare conditions with those at home. The countries of the Far East are still in a state of flux and development, and the more socialised needs of their inhabitants are met chiefly by imports; similarly the machinery for the growing industries is imported. The developed areas of the world send their ships to the Far East to gather in raw materials, and so large seaports have been created: thus, it comes about that the foundries in the Far East are mainly concerned with repair work and renewals, and with the shipbuilding industry to which most of the foundries are ancillary. There are few, if any, foundries of importance in the Far East operating as independent units; they are usually conducted by the shipbuilding or engineering firms. The industry is not an important one from the standpoint of tonnage produced but is an essential adjunct to the development of the countries which they serve.

As may be expected, the chief foundry centres are the sea-ports, which are Singapore, Hongkong, Canton, Shanghai, and Manilla. Labour is plentiful and cheap; the skilled labour, which is almost entirely Chinese, is dexterous but not possessed of a sense of craftsmanship. Strict supervision is necessary to ensure complete co-operation between the different classes of workmen. For example, a coremaker is apt to lose all interest in a core after he has made it; drying and assembly are simply not his business. The patternmaker is rarely seen in the foundry, nor the moulder in the machine shop. Nevertheless, the native workman can and does produce excellent work of any type. He needs tactful handling; it is difficult to lead him, he becomes stubborn when driven, but he can be shamed into producing good work—"face" is all-important. When handled properly and with understanding, he is the equal of any foundryman, save only in stamina and perhaps in the realisation that plumbago and chaplets are expensive and not intended merely to beautify a mould.

As a rule, the foundries are operated under British technical supervision, with a Chinese contractor or "Number One" who employs the labour required and is paid a fixed rate per pound of good castings produced, the rate varying according to the difficulty of the casting.

Owing to the fact that the foundries are almost entirely jobbing ones, machine moulding is not commonly resorted to, and mass-production is non-existent. Green-sand moulding is common, but dry sand is often replaced by loam moulding, using full patterns; this is due to the lack of good moulding sand. The dressing of castings is usually carried out manually, but mechanical appliances are becoming more common.

The only ports possessing foundries of note are Singapore and Hongkong. The other centres have foundries capable of turning out excellent castings, but possess nothing outstanding in the way of equipment. It may be mentioned, however, that in Shanghai there are foundries operated and owned by Chinese making castings for textile and printing machinery, in addition to the British-owned dockyard foundries.

Singapore

Singapore is a busy centre of foundry activity; there are innumerable Chinese foundries and two large British foundries. One of the latter is operated by the local dockyard and produces castings up to 25 tons in weight in iron and up to two tons in brass and bronze, the equipment including ordinary cupolas and (for non-ferrous metals) oil-fired tilting and pit-type furnaces. Perlit iron is also made.

In the other British foundry are two Tropenas converters of two tons capacity, from which steel castings up to ten tons are produced. There are four cupolas and iron castings up to 20 tons are made. Small brass castings can also be produced. The foundry is mainly engaged on jobbing work for the tin, rubber and marine-engineering industries, but a fair quantity of repetition work is produced on pneumatic moulding machines and with a Sandslinger. There is a sand-preparing plant in operation, and strict control is kept on the sand mixtures, all of which are made from local sands.

Hongkong

Hongkong is perhaps the busiest shipbuilding centre in the British Empire outside of the Mother Country. There are two large shipbuilding and engineering firms in the colony, each with a dry-dock about 800 ft. long and with other dry-docks and slipways. There are at present two ships of 10,000 tons being built, in addition to several other smaller craft. Both operate foundries under metallurgical control and possess modern laboratories. In one of the dockyards there are three electric arc furnaces of 2 tons capacity, and steel castings are made in carbon and alloy steels. The cupolas are of the balanced-blast type and castings are made up to 25 or 30 tons weight. In the non-ferrous foundry are oil- and coke-fired crucible and tilting furnaces and an air furnace of about 3 tons capacity.

The foundry operating in the other dockyard does not make steel, and is confined to iron and non-ferrous castings. The melting plant includes a 5-ton Brackelsberg furnace and three cupolas having up to 7 tons an hour melting rate. The largest casting made is 25 tons in weight. The non-ferrous foundry is equipped with oil-fired tilting and lift-out crucible furnaces in addition to a battery of 20 coke-fired pit furnaces. The castings include manganese-bronze propellers up to 2 tons. Owing to the lack of good moulding sand, a synthetic sand is prepared in a small, but modern, preparing plant.

There are also several smaller foundries in the colony producing such diverse castings as lamp-posts and piano-frames.

On the whole, there is nothing remarkable about the equipment of the Far Eastern foundries. Their chief interest lies in the difficult conditions under which they work—conditions of excessive heat and humidity, or of excessive cold; lack of materials and of skilled labour, and, lastly, the remoteness from fellow technicians felt by the writer and his colleagues.

SCANDINAVIA

(*Continued from page* 67.)

to the foundries, such as radiators, cast-iron soil pipes, of which Denmark now casts about 6,000 tons a year, and which had before always been imported, stove grates, boilers, motor vehicles and traffic signals. All these articles were previously imported, and a great many others are now giving work to the local foundries.

The aluminium industry in Norway has developed into a very large industry, and has now succeeded in reaching a leading position in this field, both in regard to cast metals and pressed work.

The iron and steel foundries, the engineering industry and shipbuilding were some of the most active industries in Scandinavia during 1938. Inasmuch as Denmark is not strictly an industrial country, it is indeed very interesting to see how well it managed to hold its place, particularly regarding the manufacturing of Diesel engines and shipbuilding. The total tonnage of shipbuilding in Denmark was 26 per cent. larger in 1938 than in 1937, and the value is approximately four and a-half million pounds. The export figures for finished machinery in 1938 are 33 per cent. over the export value in 1937, amounting to about 2.3 million pounds, of which three-quarters of a million were Diesel engines.

Business conditions are very dependent on the prices paid for raw materials, which are practically all imported, and lately the finished products have been placed on the market at prices far below the cost of manufacturing the same articles in Scandinavia. This condition is due to export premiums paid by other countries, a method of competition which is absolutely impossible to meet, and which has caused some anxiety.

Denmark's principal imports from Great Britain are as follow:—

	1937.	1938.
	£	£
Iron and steel ..	1,000,000	1,200,000
Machinery	313,400	350,550
Other commodities ..	22,385,100	19,156,728

Industrial Outlook for 1939

Business conditions at the present time look very favourable, and most of the iron and steel foundries have booked orders for a few months into the New Year. A few firms are working three shifts and have scheduled production almost a year in advance. The labour conditions are fairly well settled for 1939. It cannot be overlooked, however, that much depends on the general European conditions, and particularly on the prices of raw materials, in a country that is dependent on imports for almost all its raw materials.

Effects of raw-material conservation in—

GERMANY

By

Dr.-Ing. Th. GEILENKIRCHEN

Editor, "Die Giesserei"

IN last year's report the author stated that the characteristic feature of the development of the German foundry industry was that the exceptional demand for ferrous and non-ferrous metal products had also necessitated exceptional measures, and that where the consumers of ferrous and non-ferrous metals had not of their own free will made suitable re-arrangements, it was necessary for the demand to be controlled by the State supervisory departments. The consumption of iron and steel was restricted to purposes for which these materials are indispensable, while all other articles for which other materials are equally suitable, chiefly ceramic products and synthetic resin plastics, had to be made of such materials.

Plastics Oust Castings

During the last few years, the industry of synthetic resin plastics, produced mainly on the basis of organic substances, has grown so considerably that it has been possible to use these materials in place of light metals and other cast metals for mass-produced articles intended for everyday use, and even for engineering purposes, so that metal works, including the light-alloy and heavy-metal foundries and even the iron and steel foundries, have been deprived of a considerable part of their markets. It has not, however, been necessary to restrict their production, because the light-alloy industry has been able to enter the markets of the heavy-metal industry and the iron and steel industry, so that the production of the non-ferrous metal foundries has not diminished, but has even increased substantially within the framework of the principles governing raw materials.

Light Alloys

Finally, however, the entire development has helped to release large quantities of iron and steel products for other purposes. This development has appeared not only where the mechanical properties of the products are not expected to satisfy special requirements, but as the result of systematic research (which, furthermore, is directed along the same lines as in other countries with an important metal industry) it has been possible to improve the properties of alloys, so that all of them are capable of satisfying the demands placed on them. In this way, the light-alloy foundry has grown to be an important branch of the foundry industry.

Much progress in industrial life, in motor-car engineering, aircraft construction, in electrical engineering and in other branches would not have been possible without the introduction of numerous suitable light alloys. It has been possible to develop alloys with special properties, such as high resistance to heat, excellent resistance to corrosion and sea water, excellent polishing properties and suitability for receiving additional surface protection. Automatic lathe alloys on an aluminium basis and bearing metals with ample running properties and maximum specific load-carrying ability have been produced. By means of homogenising and age-hardening processes, such light alloys can be made to meet widely varying demands.

Magnesium Alloys

In this connection, magnesium plays a very important part, because it can be produced entirely from German raw materials. In accordance with the economics of German raw materials, therefore, it was an obvious matter to utilise the applicability of this metal in all directions, and this has been accomplished by processes for increasing the fineness of the grain, heat-treatment methods and expedient methods of moulding and casting. For instance, alloys with a previously unsuspected speed of cutting have been produced. The entry of the light-alloy foundry into the sphere of the heavy non-ferrous metals has produced the necessary alleviation without which it would have been impossible to fulfil the most important problems of this branch of the non-ferrous foundry industry.

In the field of non-ferrous copper alloys, also, many new alloys have been produced for all purposes. The traditional red brasses and bronzes for bells and household articles, artistic castings and mechanical purposes have been joined by the non-corrodible and sea-water resistant brasses, special high-strength brasses and other alloys. In the lead bronzes, bearing metals having good running properties and less affected by currency problems have been produced.

Of particular importance from the point of view of the saving of currency is the development of the aluminium bronzes, the significance of which is not yet fully realised. These alloys, with their high or even very high strength values, outstanding chemical properties, high resistance to wear and heat-treatment properties, not only supplement the tin bronzes, but in many cases are capable of replacing them. Special reference should also be made to the rapid development of die-casting and pressure-casting, not only of zinc-base alloys, but also aluminium-base and magnesium-base alloys.

A Little Goes a Long Way

With regard to iron and steel castings, it can merely be stated that foundries have zealously endeavoured to counteract as far as possible the advance of the light metals, plastics and weldings, favoured by the course of development, by the lightest possible constructions requiring little iron. In this connection most foundries have made a virtue of necessity, and have endeavoured to produce as many finished articles as possible from the available amount of raw material, which is still limited despite the considerable growth of German pig-iron production. These efforts, in rational co-operation with the engineering industry, and, as regards consumer and builders' castings, with the builders' merchants, have not only been aimed at reducing as much as possible the weight of the castings for the same quality, while taking full advantage of the attainable strength values, but above all at raising to a maximum figure the total yield of the melting and casting process by reducing the melting loss, waste due to runners, risers and scrap castings. The State Centre for Economic Development (one of the objects of which is to advise industry in the economising of iron by standardising and typifying alterations in design and other measures, and at the same time to ensure the maintenance of quality and the technical capacity of the various works), has had a beneficient effect in this direction.

In the production of pressure piping, the efforts commenced some years ago with the object of replacing the standardised pipes, which had previously been found by experts to be heavier than necessary, by lighter pipes have met with complete success, the latter having almost entirely displaced the standardised pipes. This development has been materially assisted by the centrifugal casting process which has gradually been adopted for a considerable proportion of pipe production. The position is similar with regard to the production of drain pipes. In pressure-pipe couplings, rubber packings in various constructions, of which much has been said in the past few years, have been adopted throughout.

An important problem for pressure pipe-lines is protection against internal and external corrosion, which is a serious necessity not only on account of the security of the pipe-lines, but also on account of the necessity for avoiding premature replacements. General research on corrosion is being successfully prosecuted with a view to perfecting this protection.

Roll Castings

The progress made in recent years in the casting of rolls is also particularly noteworthy. Germany has an old-established roll foundry industry in Siegerland which produces rolls of excellent quality, due to the occurrence of the high-grade Siegerland spathic iron ore, the export of which, owing to its world-wide reputation, was maintained at a high level even in the worst days of the German export trade, and to-day also forms a considerable proportion of the total German exports.

In view of the excessive orders received by German rolling mills, the home demand for rolls is also exceptionally large, and roll foundries, in order to be able to satisfy their customers' requirements, have been compelled to increase continuously the strength of their rolls to enable the attainable tonnage to be raised to a maximum figure. To meet the wishes of their customers, the roll foundries have spared neither expense nor trouble, and can claim to have contributed their share in the increase and cheapening of rolled products.

The only charcoal blast-furnace plant of Sulzau-Werfen, in Salzburg, which is still in existence in Austria and which produces rolls and steel plant ingot moulds of outstanding quality, has become since the annexation of Austria the only charcoal blast-furnace plant in Greater Germany.

Co-operation in Non-Ferrous Foundry Practice

By Dr. WILLI CLAUS

Paper presented at the Polish International Foundry Congress.

Whenever the necessary co-operation between designer and foundryman is usually discussed, the designer is principally concerned with complaining about "excessive waste," and the foundryman with complaining about "wrong design" which cannot be corrected in the foundry. Generally, if a dilemma arises, it is always solved by the very simple relationship existing between supplier and customer, the supplier being the sufferer in accordance with a primitive natural law.

It is not intended in this Paper to make any comment on this complex problem as restricted to the special field of non-ferrous metal foundry practice, because there is no direct solution of the problem on the basis, for instance, of legal or commercial considerations. The following remarks are rather intended to clear up the question of the relationship between the designer and foundryman in the field of non-ferrous metals in another way, *i.e.*, by telling the designer what modern foundry practice actually signifies as the result of its development during the last fifty years.

If the development of non-ferrous metal foundry practice during the last 70 years be considered in its broadest aspects, it must be realised that this foundry practice has evolved from a craft to a science; in other words, it has passed from the narrowly-confined completed province of craftsmanship to a sphere in which there is constant evolution. This fact can be recognised in an abundance of new materials, the establishment of scientific principles in the field of metallurgy, in endless developments in the purely mechanical field of works practice and at the same time in a comprehension of the economic factor in the field of general industrial economics and the national and international economics of metal production.

Seventy Years Ago

About seventy years ago, the situation with regard to materials was very simple. In the first place, quantitative knowledge of the mechanical and technical stresses to which machines and apparatus were subjected was almost nil, and in the second place, knowledge regarding the performance of materials was approximately on the same level. In modern constructional engineering, all this has altered. Not only is there definite and reliable knowledge of the mechanical and constructional stresses to which machines and apparatus are subjected, but almost daily and hourly new stress factors are being worked out with which, in the nature of things, it is impossible for either the knowledge of materials or foundry practice to keep pace in any way.

It should therefore be made clear to the designer what non-ferrous metal foundries have to offer nowadays in the shape of cast materials. The leading position in this respect is occupied by the work done in connection with cast copper, which has furnished the designer, particularly for articles of high thermal conductivity, with a hitherto irreplaceable material of the highest conductivity ensuring reliability of operation under stress at high temperatures. From the point of view of foundry practice, the weight of such castings has been increased to 4 and 5 tons.

Of the copper alloys, the tin bronzes have been subjected to a careful study, ensuring the production of all kinds of castings of such alloys with reliable mechanical properties. Regarding the modifications of tin bronzes, the values attained by the red-brass alloys, due to the introduction of new foundry methods, in particular centrifugal casting, by taking advantage of the structural changes occurring during solidification when this method is employed, are of such a nature as to make it possible to employ low-grade alloys instead of high-tin alloys, especially for bearings. Thus, the red-brass alloy 5 of the German Standards Specification (DIN 1705) is the equal of cast bronze 14 of the same Standards Specification.

Aluminium Bronzes

With regard to the infinitely large group of special bronze alloys, of which the beryllium bronzes have deserved special interest, reference will be made here to only two of its members, namely, the aluminium bronzes and lead bronzes, which are of the greatest importance. The aluminium bronzes have been studied with regard to their behaviour in the foundry. The serviceability of this alloy group lies in two directions. In the first place, for economic reasons, these alloys are suitable for replacing tin bronzes in countries having no tin mines of their own, and secondly they have particular advantages with regard to their mechanical properties and their corrosion-resisting properties. From the point of view of their metallurgical type, the aluminium bronzes are an absolutely new kind of alloy for the non-ferrous foundry. Their metallurgical characteristics require them to be used predominantly in the form of chill-cast material, that is to say, permanent moulds are employed in the production process, their advantages being best developed in mass-production methods. Any other method of utilising aluminium bronzes can easily result in failure. The onus for such failures should not be placed on the foundryman, who advises to the contrary but who is obliged to carry the designer's ideas into practice.

Regarding the lead bronzes, it will merely be mentioned that the art of casting lead bronze as composite castings having steel supporting bushes and lead bronze bearing surfaces has to-day reached such a degree of perfection as to ensure the technical reliability of the process. Such castings are capable of withstanding the highest bearing stresses of internal-combustion engines, *i.e.*, bearing pressures of up to about 7,000 lbs. per sq. in. at speeds of about 32.8 ft. per sec. or more.

Up till now, simple brass casting has mainly been a branch of sand moulding for all kinds of engineering components, but preferably for fittings and artistic castings. The mechanical performances and stresses of castings of this kind have been relatively low.

Pressure Die Casting

In the last few years, enormous strides have been made in two directions as the outcome of the development of the pressure-casting process, ensuring high average mechanical properties, together with guaranteed accuracy of dimensions of the castings. The economic usefulness of the pressure-casting process is in healthy competition with the production of normal cold-pressed parts.

In the last three years, a serious competitor to this process has appeared in the shape of the simple brass chill-mould casting process, the importance of which at present cannot be fully ascertained. It would appear that an absolutely economic intermediate member is being developed here between the single-piece pressure-casting process and the ordinary sand-casting process, and is deserving of the closest attention on the part of the designer.

Special Brasses

The special brass alloys offer a choice of tensile strength ranging from 22 to 38 tons per sq. in. for elongations of 30 to 15 per cent. and Brinell hardness numbers of 80 to 130. The development of special brass alloys has brought to the front a new group of materials which are not being employed by designers to the extent which would appear desirable.

There must now be some plain speaking between the foundryman and designer:—Materials such as aluminium bronzes and lead bronzes in the form of composite materials or special brasses offer the maximum performance, and the designer ought to require the maximum performance offered. The fulfilment of this requirement naturally presupposes that the requisite materials are ordered from firms of whose efficiency the designer can be absolutely sure before placing the order. It is not as if the attainment of such maximum performance values for these special materials is possible without difficulty; on the contrary, the guarantee that a given order will be properly carried out is based on years and often decades of experience. This should be borne in mind when orders are being placed, and much unpleasantness and misunderstanding will certainly be avoided if the designer is aware of the responsibility involved in placing orders for high-performance materials. It is, however, also erroneous to draw general conclusions as to the position of brass foundry practice from failures due to the above causes.

A word must be said in all seriousness with regard to prices. In all cases, the production of high-duty materials requires much experience and investment, in addition to special progressing and the maintenance of a highly qualified staff. This means that to beat down prices for pseudo-commercial reasons is quite out of place.

Nomenclature

In dealing with the special brasses, designers should preferably employ the accepted nomenclature of metallurgy. It is nowadays incorrect and shows evidence of scant technical knowledge to order "special brasses" by fancy names, such as "refined bronzes." The nomenclature of alloy technology is simple and definite. The standard specifications in the different countries are available as a pattern for the unification of the nomenclature.

National Economy and Nickel Alloys

Regarding nickel alloys, mention will merely be made of an alloy of nickel (65 to 70 per cent.) and copper (25 to 30 per cent.), with low iron and manganese contents. This alloy is known as Monel Metal when it is produced by direct smelting from ore. In Germany, the same alloy produced by alloying the component metals, and having the same mechanical and chemical properties, is known by various names in the trade.

In connection with this alloy, there has been development directed towards reducing the high nickel content. A reduction in the nickel content would be accompanied by advantages with regard to foundry practice as well as from the economical point of view. Such reduction in the nickel content, however, is only possible if the principal requirements which the alloy has to satisfy—mechanical properties, chemical resistivity and colour—are not materially affected. A systematic investigation of the cast condition has shown that the chemical resistivity of the alloy undergoes as little change on reducing the nickel content to about 25 per cent. as the light-reflecting power, while the mechanical properties are retained. It has thus been possible to settle the problem concerning the reduction in the nickel content of the alloy.

Zinc and Lead Alloys

Regarding the lead alloys employed as cast, the principal interest is the extraordinary development of bearing metals. Cast materials have been created which not only attain but

even surpass the efficiency of the former bearing metals of high tin content. The production of lead alloys, in particular lead-antimony alloys, on a large scale for acid-proof castings is a recent achievement.

The main field of application of the zinc and lead alloy groups is the large-scale production of precision castings owing to their low melting points and general physical properties.

Zinc alloys with contents of aluminium and copper acquired an unenviable reputation in the early period of precision casting production due to their lack of constancy of dimensions. Systematic large-scale investigations by both American and German foundrymen have resulted in the discovery of practically age-resistant die-casting zinc alloys which, as regard their maximum mechanical properties, attain the limit of the lower grades of steel castings while possessing a previously unheard-of accuracy of dimensions and giving outputs of hundreds of thousands of castings from the same mould.

It may also be mentioned that these zinc alloys have so far scarcely been used for simple chill-mould castings, despite their eminent suitability for this method of manufacture. The mechanical properties of chilled zinc castings are extremely satisfactory, the tensile strength being about 15.9 tons per sq. in., with a 0.02 per cent. yield point of 9.5 to 11.5 tons per sq. in., an elongation of 0.2 to 2 per cent. and an impact bending strength of 47.3 ft.-lbs. per sq. in. With regard to lead alloys, for which, of course, the metallurgical laws apply, their use as simple chill castings is obvious, but with regard to zinc alloys, as already stated, their application, strangely enough, has not been developed to the same extent, although it offers considerable economic advantages.

The chief position in the group of light metal alloys is occupied by the alloys of aluminium and magnesium. They can be produced conveniently in all moulding materials and are suitable for all methods of casting, whether plain casting, die casting or centrifugal casting. The limiting values for the tensile strength fluctuate between 7.6 and 21.6 tons per sq. in., the elongation between 0.5 and 15 per cent. and the Brinell hardness between 50 and 120. This group of alloys comprises simple alloys and those which are capable of subsequent improvement (age-hardening) by heat-treatment. The size of the castings varies from ounces to hundredweights.

Commercial Aspects

The foregoing comments have dealt exclusively with the subject of materials. Further remarks concerning foundry metallurgy and general works practice and works economy are unnecessary. Development and the attainment of a high degree of perfection in one field are inconceivable without high efficiency in the other fields.

These statements now entitle the designer to ask: "If everything in non-ferrous foundry practice is so fine, why do we have difficulties (1) due solely to questions of material and (2) due to the terms of delivery?" This calls for the retort that the development of scientific foundry practice has reached a stage which permits the assertion that designers can scarcely set any problems which cannot be solved, provided the possibility of solving them resides within the scope of foundry practice at all.

Modern Methods

If to-day difficulties occur in the placing of orders and the execution of exceptional castings, then apart from wrong dispositions on the part of the designer, as dealt with in the foregoing, such difficulties can be mainly attributed to the time factor. In principle, the position in any high-grade non-ferrous foundry is such that a difficult new order (the author has here in mind the die-casting foundry) can no longer be executed forthwith like a straightforward foundry job of 50 years ago. To carry out the order, the supervisory staff down to the foundry foreman has to make arrangements and possibly perform a considerable amount of mental work. The production of satisfactory castings, even when all foundry problems have been cleared up in the works and possibly by discussion with the designer who gave the order, often requires days of work in the experimental department. If it is necessary to satisfy certain requirements regarding mechanical efficiency or pressure-tightness, further days of work will have to be done until the part has been so perfected with regard to gating, venting and risers that the designer's requirements will be fully met and continuous and steady production assured.

Such performance—it should be repeated that the example selected of a die-casting foundry is only one of many others—cannot be forced with short-period delivery terms. Apart from the actual work to be done, there is also the ever-present shortage of labour, when the market conditions are at all good, and the resulting general overworking of the staff. Therefore, when maximum performances are to be attained, it is unjust to create difficulties for the foundry from the outset by imposing short delivery terms.

Design and Delivery

These statements will have shown that the relations between the designer and non-ferrous metal foundryman cannot be cleared up by complaining about "unsatisfactory deliveries" and "wrong design." These statements are an earnest request for the designer to give due recognition to modern foundry practice, such as has been given to the work and performance of the constructional engineer for decades.

The mutual recognition of the work performed in both fields raises the question of the relations of the designer and foundryman to quite a different plane, to the "plane of the material" itself. On this plane, however, there is no room for trivial criticism but only for co-operation which may be effected in accordance with a very simple scheme.

The designer will bring his difficulties with regard to material to the foundryman and will ask him whether for the given application and for the performance required a certain foundry material will be suitable, what performance is to be expected with the prescribed method of casting and when delivery is to be expected if the order is given. After studying the problem, the foundryman will in his turn consult the designer regarding the possible solutions. This exchange of ideas will result in a fruitful reciprocity which will render available much knowledge that is still localised in a one-sided manner.

Specificational Requirements

It may be recalled, for instance, that even to-day in the standard specifications of many countries for cast non-ferrous metals the yield point does not appear as an important modern constructional value. These standard specifications are 10 or 20 years behind the actual position of the art, a state of affairs which could be removed most rapidly by a close collaboration between designer and foundryman, because the foundryman could learn much from the designer through this mutual exchange of ideas, while in his turn the foundryman could undoubtedly furnish important contributions to the problem of the yield point of the same material when sand cast and when chill cast which at present are known to him, the foundryman, from his own specific experience.

The final result of such activity would be the joint control or mastery of the material, which is the ultimate aim of all the efforts made by both designer and foundryman. The preliminary conditions for this control of material are already to a considerable extent in the hands of the designer and the foundryman, as it is hoped that the foregoing remarks have shown. No efforts should be spared on either side in the endeavour to attain the desired object.

Wages in the Light-Castings Industry

THE SITUATION EXPLAINED

IN a statement on January 6, Mr. George Scotland, manager of Falkirk Iron Company, Limited, and President of the National Light Castings Federation, explained the position which had arisen in the light-castings industry, consequent upon proposals made by employers to reduce the wages of men engaged in the manufacture of cast-iron rain-water and soil goods. The situation had given rise to reports indicating the possibility of a strike.

In an interview with our Scottish correspondent, Mr. Scotland said that there was no dispute regarding wages, and, so far as strike action was concerned, that had not been mentioned by any side. During the past two years, both the men's unions and the employers' federation had been greatly concerned at the falling-off in demand for cast-iron rain-water and soil goods. During the last 12 months this had become so very serious that a large number had been thrown out of work, and practically every foundry dealing with this class of work, in Scotland and England, had been on short time.

Mr. Scotland pointed out that the local workers, as was well known, had been on four days a week, and in some cases three days a week. In one or two instances, the manufacture of this class of goods had been stopped altogether. Because of these circumstances, the executives of the trade unions and the employers' federation had met several times in conference to discuss ways and means of improving the position. A serious feature of the situation was that the falling-off in demand was resulting not only in a check in housing scheme work, but in cast iron being substituted by other materials, particularly in regard to gutters and pipes.

Principal among these substitutes, said Mr. Scotland, were asbestos and stamped steel, which could be supplied at prices very much below what had been possible for cast-iron goods. It was therefore necessary that action should be taken to reduce the prices of the cast-iron material. The reduction required was very drastic, and it was agreed among the parties concerned that they could not possibly be borne by one section alone. The ironfounders were prepared to make a heavy "cut."

Through negotiations with the merchants' associations, a reduction in distributing charges was agreed upon. The executive of the trade union had also agreed that some concession would require to be considered. At the last meeting held in Glasgow on December 27, agreement on these points was reached. The ironfounders had put into force the reduced prices, and the merchants' associations had agreed to their contributions. The meetings to decide the amount that the workers would contribute were then being held.

Meeting of Workers

A joint meeting of the Ironfounding Workers' Association and the National Union of Foundry Workers was also held in Falkirk on January 6. The meeting was presided over by Mr. Sam Glass. Mr. Glass and Mr. Logan, addressing the meeting, which was composed of members engaged in the production of rain-water and soil goods, reported on a conference with the employers on the question of wages. The executive committee, they said, had recommended the acceptance of a reduction of 7½ per cent. in wages, but that could only be determined by ballot.

The meeting, after hearing the report, unanimously passed a vote of confidence in the executive. It is understood that the ballot papers are being given out to the men concerned and will be returned during this week.

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The Week's News in Brief

Trade Talk

DURING 1938, 54 new factories were established on the Great Western Railway system, of which 25 were in South Wales.

AT AN EXTRAORDINARY MEETING of Petters, Limited, a special resolution changing the name of the company to Associated British Engineering, Limited, was carried unanimously.

AN ORDER for a 20,000-kw. Brush-Ljungstrom turbo-alternator, costing approximately £70,000, has been secured by the Brush Electrical Engineering Company, Limited, Loughborough, from the Halifax Corporation.

THE DUKE OF GLOUCESTER has consented to be principal guest and speaker at the banquet to be given by the Government at the Mansion House, on February 20, to mark the opening of the British Industries Fair. The President of the Board of Trade, Mr. Oliver Stanley, will preside.

THE NO. 2 BLAST FURNACE of the Millom & Askam Hematite Iron Company, Limited, of Millom, Cumberland, made in December the following records: December 23, 433 tons (record day's output); week ending December 31, 2,608 tons; month ending December 31, 10,956 tons (a record output). These have been accomplished on a 14 ft. 10 in. diameter hearth with hand charging, and are believed to provide a record output for a hand-charged furnace.

"ONE OF the most modern factories that money can put up" was a description applied last week by Major W. T. Kitching, general manager, to the extensions to be made at the Thorncliffe Ironworks, Chapeltown, of Newton, Chambers & Company, Limited. Work on the extensions is to be commenced immediately, and, it is hoped, will be completed by the end of the year.

THE FOLLOWING DONATIONS have been made to Scottish charities (generally speaking, hospital funds) during the past year by the employees of foundries and similar concerns:—Argus Foundry, Thornliebank, Glasgow, £96; William Arrol & Company, Limited, Glasgow, £705; Archibald Baird & Son, Limited, Hamilton, £119; Barr & Stroud, Limited, Anniesland, Glasgow, £296; Blantyre Engineering Company, Limited, £75; Cameron & Roberton, Limited, Kirkintilloch, £209 10s.; Coltness Iron Company, Limited, £5,405; Cochrane & Company (Annan), Limited, £266; A. F. Craig & Company, Limited, Paisley, £198; James Howden & Company, Limited, Glasgow, £400; Jones & Campbell, Torwood Foundry, Larbert, £425; Lancefield Foundry Company, Limited, Glasgow, £30; Mirrlees Watson Company, Limited, £371 (plus £150 from the firm); North British Locomotive Company, Limited, Glasgow, £893; Wm. Simons & Company, Limited, Renfrew, £421; Shaw, Glasgow, Limited, Maryhill, £235; Springfield Steel Company, Limited, Glasgow, £73, and D. & J. Tullis, Limited, Clydebank, £288.

IN ACCORDANCE with the policy of consolidation which is now in progress, General Refractories, Limited, announce that certain subsidiary companies are being placed into voluntary liquidation for the purpose of amalgamation. The following companies are being liquidated for the purpose of amalgamation with General Refractories, Limited:—Armitage Works Company, Limited; Henry Brooke & Company (Denholme), Limited; W. H. Girling & Company, Limited; Guiseley Silica Company, Limited; Midland Refractories Company, Limited; Weeland Sand Company, Limited, and Ambergate Colliery Company, Limited. In addition, the following companies are being liquidated for the purpose of amalgamation with the Glenboig Union Fire Clay Company, Limited:—Castlecary Fireclay Company, Limited; Faskine & Palacecraig Bricks and Coal, Limited, and George Turnbull & Company, Limited. Also, South Wales Refractories, Limited, is being liquidated for the purpose of amalgamation with N. B. Allen & Company, Limited, which company, subject to the consent of the Board of Trade, proposes to change its name to N. B. Allen & South Wales Refractories, Limited. The scheme of consolidation now being carried into effect will, it is considered, result in considerable economies, and will simplify control of the trading activities of the group.

Personal

SIR PAUL BOOTH, of Booth & Brookes, Limited, accompanied by Lady Booth, is leaving this week for a six-months' cruise to South Africa and South America.

MR. R. G. RUSSELL, an Australian member of the Institute of British Foundrymen, has been included in the national committee to investigate the large-scale production of aero-engines in the Dominion.

SIR FRANK E. SMITH, K.C.B., D.Sc., LL.D., F.R.S., will relinquish his appointment as Secretary to the Committee of the Privy Council for Scientific and Industrial Research on January 31. Prof. E. V. Appleton, D.Sc., LL.D., F.R.S., at present Jacksonian Professor of Natural Philosophy in the University of Cambridge and Fellow of St. John's College, Cambridge, will succeed Sir Frank Smith.

Will

HELLEWELL, H. E., chairman of Marsden's Engines, Limited, Union Foundry, Heckmondwike	£5,092

Obituary

MR. JOHN SCOTT, who died last week at Ashtead, Surrey, aged 87, was the oldest member of the Institute of Metals, of which his son, Mr. Gilbert Shaw Scott, has been secretary since its foundation in 1908.

THE DEATH has occurred, in his 80th year, of Mr. Harry Roberts, chairman of Wm. Roberts & Sons, Limited, engineers, of Phœnix Foundry, Nelson, Lancs. He was the second son of the late Mr. William Roberts, who founded the business in 1861.

Company Report

J. Brockhouse & Company (Ireland), Limited.—Loss to October 31 last of £45, after all charges and depreciation, making the debit balance carried forward £11,768.

Contracts Open

Bradford, January 24.—Cast-iron gullies, ventilators, etc., for 12 months ending March 31, 1940, for the Corporation. The City Engineer, Town Hall, Bradford.

Cheltenham, January 21.—Cast-iron pipes, castings, lead pipe, tin, etc., white lead, wrought iron, steel and files, for 12 months, for the Town Council. Mr. G. G. Marsland, borough engineer, Municipal Offices, Cheltenham.

BELGIUM

(*Continued from page* 66.)

time onwards a progressive slowing up occurred, which reached its peak in October. At this time, the works were completely shut down for several weeks.

In November and December, this speciality picked up somewhat, following the improved outlook in the heavy industries.

Non-Ferrous Foundries

The year 1938 was frankly disappointing compared with 1937, which was passably good, at least right up to September. From that moment the level of business has seriously decreased. A slight improvement was evident during the April to June period, but from July onwards the turnover has fallen right down to the particularly low levels of 1932 and 1933. Even the better conditions of April to June cannot be attributed to engineering requirements, but solely to work emanating from building activities.

Company Meeting

Cannon Iron Foundries, Limited

The annual meeting of Cannon Iron Foundries, Limited, was held at Deepfields, Bilston, on Friday, December 30. MR. G. A. LEITCH (chairman), who presided, said that the turnover had not fallen off to the extent which might be inferred from the trading results, but business in the iron trade and in building operations, on which they were largely dependent, had declined considerably during the year, and their company had not been able to avoid the general recession. It was inevitable that the reduction in the volume of available business resulted in the intensification of competition, both in this country and from abroad, with a consequent reduction of profit margins. In addition, they had felt the full effects of higher costs in wages and materials this year, against which they had not been able to increase their selling prices.

New Companies

(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.)

High Grade Castings, Limited, Linslade Works, Leighton Buzzard, Beds.—Capital, £75. Directors: J. B. Corrie, A. J. Baillot, A. S. Beech and A. G. Corrie.

H. Pickup, Limited, Roscoe Street, Scarborough.—Capital, £12,500. Ironfounders and constructional engineers, etc. Directors: H. Pickup, W. Phillips, H. Pickup, junr. and H. M. Pickup.

Patent Specifications Accepted

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each. The numbers given are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

493,311. HATFIELD, W. H., and BRIDGE, J. F. Alloy steels.

493,342. STERNBERG, J. DE. Machines for the casting under pressure of metals.

493,349. CURRAN & COMPANY, LIMITED, E., and CURRAN, T. Annealing and pickling of hollow metal articles.

493,435. LUHR, F. A. Centrifugal apparatus for removing rust, scale, and the like from metallic surfaces.

493,475. LUHR, F. A. Centrifugal apparatus for removing rust scale and the like from metallic surfaces.

Forthcoming Events

JANUARY 16.

Institute of Metals (Scottish Section):—"Development of Corrosion-Resisting Aluminium Alloys," Paper by G. W. Lacey, at 39, Elmbank Crescent, Glasgow, at 7.30 p.m.

JANUARY 17.

Institute of Metals (Scottish Section):—"Practice in Mechanical Testing," Paper by V. E. Green, at James Watt Memorial Institute, Birmingham, at 7 p.m.

Institute of British Foundrymen

JANUARY 19.

East Anglian Section:—"High-Duty Cast Iron," Paper by J. H. Williams, at Central Library, Ipswich, at 7.30 p.m.

JANUARY 20.

Lancashire Branch (Junior Section):—Short Paper Competition, at College of Technology, Manchester, at 7.30 p.m.

JANUARY 21.

Bristol Section:—"Moulding and Casting Propellers," Paper by M. Wayman, at Merchant Venturers' Technical College, Bristol, at 7 p.m.

The Institute of Vitreous Enamellers

JANUARY 19.

Midland Section:—"Future of Porcelain-Enamelled Iron as a Building Material," Paper by P. Blackburn, at Chamber of Commerce, New Street, Birmingham, at 7.30 p.m.

JANUARY 21.

Scottish Section:—Joint meeting with Falkirk Section of I.B.F. "Foundry and Enamel Practice as Applied to Cast Iron." Paper by G. M. Logan, at Temperance Café, Lint Riggs, Falkirk, at 6 p.m.

Raw Material Markets

The opening week of the year was quiet, and not much business has been done in the iron and steel trades, owing to the fact that New Year holidays did not end in many cases until Monday last. There has now been a general resumption at the consuming works, and business placed within the next few weeks is likely to provide some indication of the trend of trade over the first few months of the year. It is anticipated that buyers will place quite heavy delivery specifications, while a number of consumers are certain to enter into new contracts.

Pig-Iron

MIDDLESBROUGH.—Although a slow start has been made in business in this area, producers are confident that there will be a good number of orders to be met within the next week or two. Many users took the opportunity of the New Year holidays to carry out essential repairs to their plant and a general resumption was not made before Monday last. Stocks were inclined to increase during the holiday period, but it is expected that these will soon be cleared. For delivery in the Middlesbrough and Falkirk areas, No. 3 Cleveland G.M.B. foundry iron is quoted at 99s., No. 1 foundry 102s., No. 4 foundry and No. 4 forge 98s., with an extra 3s. per ton for deliveries on the Clyde.

The current production of hematite is considerably in excess of the demand, and is likely to remain so for some time, as the outlook for consumers is not particularly bright, although there has recently been some improvement in the number of orders received. Fortunately, there are signs that the steel trade is entering upon a more active period, and this is expected to be reflected in the hematite section. East Coast mixed numbers are quoted at 120s. for delivery on the North-East Coast, 125s. 6d. in Sheffield, and 131s. in the Midlands, less 5s. per ton rebate.

LANCASHIRE.—Most of the works in this district resumed operations in the middle of last week. Since then there has been a moderate call for supplies of foundry iron, and it is expected that the demand will show a substantial increase in the next week or two. In some cases, consumers have covered their requirements up to the end of the first quarter, while a few have gone beyond this. Other users appear to be cautious and have not yet entered into forward contracts. The machine-tool and heavy electrical engineering sections are busy, but textile-machinery makers are not too well employed, and the outlook in this respect is not satisfactory. The jobbing foundries are hoping that there will be an improvement in the demand for their products in the near future; if this materialises it will be welcome, as this branch has not been too busy for a good time past. For delivery to users in the Lancashire price zone, offers of Derbyshire and Staffordshire brands of No. 3 foundry iron are on the basis of 104s., with Northamptonshire at 102s. 6d., and Derbyshire forge iron at from 101s. to 103s., according to the class of user. The demand for hematite is still quiet; prices are: West Coast 128s. 6d., East Coast 128s., delivered equal to Manchester.

MIDLANDS.—New business in this area appears to be largely confined to tonnages sufficient to last consumers for two or three months ahead. As yet, there has been little large-scale buying. In some cases, users are content to make their purchases on a hand-to-mouth basis, as activity at their plants is not satisfactory, while stocks are still heavy at some works. On the whole, however, the outlook is much improved, and orders for foundry iron are likely to show an appreciable increase in the near future. Firms engaged on work connected with the rearmament programme are generally working to capacity, and it is certain that there will be no recession here for a considerable time. Most of these concerns are using low-phosphorus iron and hematite, and the demand for these qualities is quite substantial. With regard to the latter, however, many users are in possession of heavy stocks. Prices of low-phosphorus iron are not controlled, and iron is being sold in this area at a minimum of £5 5s. per ton. The better qualities are priced at up to £6. The transport charges affect the price of low-phosphorus iron to a large extent, and so the highest figure is charged for Scottish iron.

SCOTLAND.—Although there has not been much activity in this market so far this year, traders are hopeful of an early improvement. Many of the works have only recently resumed operations after the holidays, but it is anticipated that many users will be compelled to take up additional tonnages in the near future. Scottish No. 1 foundry iron is quoted at 108s., with No. 3 at 105s. 6d., f.o.t. furnaces. The demand for steel-making iron is also on the quiet side at present. Hematite mixed numbers are quoted at 102s. 6d. and English and Indian basic iron at 92s. 6d., both less 5s. rebate, delivered local steelworks.

Coke

Many consumers of foundry coke are covered up to the end of the first quarter of the year. Prices have been stabilised as far ahead as the end of June, but there is little reason why users should make contracts for the half-year. The minimum quotation for best Durham and Welsh coke is 50s. 6d., delivered Birmingham and district.

Steel

There has been a moderate amount of business in the steel market during the past week, consumers taking advantage of the reduced prices. In some cases, consumers have made contracts as far ahead as the first half of the year. At present, the call for steel sheets remains at a low ebb, but the outlook in this section is quite hopeful, as it is expected that there will be a heavy demand as soon as the Government's plans for air-raid shelters are brought into operation. Steel arches will also be used to a large extent in the construction of these shelters. Heavy steel is rather quiet, and producers would welcome additional orders. The structural-steel works are not too well employed; in many cases they have a good number of orders from the Air Board on hand, but there is a scarcity of other business.

Scrap

In all districts business in the iron and steel scrap market has been very quiet during the past week. Consumers continue to suspend deliveries under existing contracts, thus indicating that they have ample stocks on hand to meet their requirements. Many steelmakers have idle plants, and are consequently using scrap on a reduced scale.

Metals

Copper.—There has been rather more business about during the past few days and the weekly market report issued by Brandeis, Goldschmidt & Company, Limited, states that "consumers have reentered the market on a moderate scale and a little more demand has been in evidence for forward delivery. It is now generally realised that the consumption of copper has been running at a satisfactory rate, and that the price must be governed to some extent by the costs of the smaller mines, even though the larger are satisfied and are curtailing output. The weakness of the sterling exchange and the improvement in United States sentiment are factors which are keeping the price of electro relatively high. The United States domestic quotation is still being maintained at the ineffective level of 11.25 cents, and optimistic producers think that the European level will sooner or later reach this parity."

Domestic sales of copper in the United States during the month of December amounted to the low total of 14,595 short tons. This was, however, an improvement on the previous month, when sales totalled 12,524 tons. The total for the year was 515,334 tons, as compared with 517,736 tons in 1937 and 964,854 tons in 1936. It is expected that there will shortly be a renewed period of buying, as the low sales during the closing months of the year would seem to indicate that consumers were working on their stocks.

Metal Exchange quotations were as follow :—

Cash.—Thursday, £44 16s. 3d. to £44 17s. 6d.; Friday, £44 7s. 6d. to £44 10s.; Monday, £44 2s. 6d. to £44 3s. 9d.; Tuesday, £43 10s. to £43 12s. 6d.; Wednesday, £43 13s. 9d. to £43 15s.

Three Months.—Thursday, £45 1s. 3d. to £45 2s. 6d.; Friday, £44 12s. 6d. to £44 15s.; Monday, £44 7s. 6d. to £44 8s. 9d.; Tuesday, £43 15s. to £43 16s. 3d.; Wednesday, £43 18s. 9d. to £44.

Tin.—A firm undertone has prevailed in this market, despite the quietness of demand. The influence of the buffer pool appears to be increasing and accentuating the resistance of the market. It is reported from Amsterdam that the manager of the tin buffer pool may shortly start sales from the buffer stocks, which amounted to 10,000 tons at the end of 1938. It is considered unlikely that the pool will hold up sales until the price of tin reaches £230.

Official quotations were as follow :—

Cash.—Thursday, £217 12s. 6d. to £217 17s. 6d.; Friday, £217 to £217 5s.; Monday, £217 5s. to £217 10s.; Tuesday, £216 10s. to £216 15s.; Wednesday, £217 to £217 5s.

Three Months.—Thursday, £218 10s. to £218 15s.; Friday, £217 15s. to £218; Monday, £218 5s. to £218 10s.; Tuesday, £217 10s. to £217 15s.; Wednesday, £218 to £218 5s.

Spelter.—Business with consumers has been quiet of late, but the favourable reception accorded to President Roosevelt's speech on the position of the United States in the event of a European war helped to firm up the undertone of the market. It is understood that negotiations are taking place between Belgian interests regarding the formation of a Zinc Cartel. It is believed that this is a preliminary move to the international discussions which are expected to take place when the British tariff question has been settled.

Daily market prices :—

Ordinary.—Thursday, £13 17s. 6d.; Friday, £13 12s. 6d.; Monday, £13 11s. 3d.; Tuesday, £13 8s. 9d.; Wednesday, £13 13s. 9d.

Lead.—A moderate industrial interest has been shown recently, but business has not involved large tonnages. The Soviet Union has continued to enter the market and buying from this source has been on a good scale. Consumption is reported to be well maintained.

Day-to-day quotations :—

Soft Foreign (Prompt).—Thursday, £14 17s. 6d.; Friday, £14 15s.; Monday, £14 11s. 3d.; Tuesday, £14 12s. 6d.; Wednesday, £14 15s.

Scrap.—On the whole, there has been very little activity in the non-ferrous scrap market and business has remained at a low level. An exception to the prevailing conditions has been duralumin, the demand for which has been strong recently.

Approximate selling prices for old metal:—New aluminium cuttings, £70; rolled, £54 to £55; cast, £32; foil, £80. Copper, £39 to £44; braziery, £35 to £36. Brass (clean), £21 to £25. Zinc, £10. Lead, £14 10s. Gunmetal, £38.

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